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**International Trends in Ocean and Coastal  
Management in Brazil**



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**International Trends in Ocean and Coastal  
Management in Brazil**

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**key-words**

Ocean and Coastal Management; Marine Spatial Planning; Integrated Coastal Zone Management; Brazil.

**abstract**

Face to the current scenario of increasing uses of coastal and marine resources, the pressures on these ecosystems also tend to increase, calling for adjustments on the prevailing forms of coastal use and in the nature of coastal and ocean management currently performed in a manner that risk management could be better addressed. Integrated Coastal Zone Management (ICZM) is being increasingly consolidated as international framework for coastal areas, whilst Marine Spatial Planning (MSP) has emerging as methodological approach for sea use management. Both concepts aim to influence the location, in space and time, of coastal and sea-based human activities, encouraging compatibility of interests and reducing impacts of current and potential uses on these environments. In light of this background, the purpose of the study is to investigate the influence of international trends in ocean and coastal management in Brazil, in theory and practice, mainly with respect to the adoption of ICZM and MSP concepts. The results have shown that Brazilian policy basis and initiatives have responded to ICZM and MSP frameworks mainly with respect to the integration of landward and seaward issues management, improvement of the knowledge about coastal and marine resources and risks management approach. The permanent link among coastal, ocean and the broad environmental policy has been able to harmonise the main guidelines, instruments and competences for planning and managing at federal and sub-national levels, improving integration of efforts and instituting a strategic planning rationality.

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## **LIST OF ACRONYMS**

**APA** – Environmental Protection Area  
**ARIE** – Area of Ecological Interest  
**CBD** - United Nations Convention on Biological Diversity  
**CCSBT** - Commission for the Conservation of the Southern Blue Tuna  
**CDB** – Convention on Biological Diversity  
**CEMAN** – Centre of Environmental Monitoring  
**CIRM** – Comissão Interministerial para os Recursos do Mar  
**CLC 90** - International Convention on Civil Liability for Oil Pollution Damage  
**CLCS** – Commission on the Limits of the Continental Shelf  
**CONAMA** – National Council on Environment  
**CSR** – Centre of Remote Sensing  
**EEZ** – Exclusive Economic Zone  
**ESEC** – Ecological Station  
**FAO** - Food and Agriculture Organization of the United Nations  
**FLONA** – National Forests  
**FURG** – Federal University of Rio Grande  
**GDP** – Gross Domestic Product  
**GERCO** – Programa Nacional de Gerenciamento Costeiro  
**GI-GERCO** - Group of Integration on Coastal Management  
**GIS** – Geographic Information System  
**GIWA** – Global International Waters Assessment  
**GOC** - Global Forum on Oceans, Coasts and Islands  
**IBAMA** - The Brazilian Institute of Environment and Renewable Natural Resources  
**IBGE** – National Institute of Geography and Statistics  
**ICCAT** - International Convention for the Conservation of Atlantic Tunas  
**ICRI** – International Coral Reef Initiative  
**ICZM** - Integrated Coastal Zone Management  
**IMP** – Integrated Maritime Policy  
**IOC** – Intergovernmental Oceanographic Commission  
**ISBA** – International Seabed Authority  
**ISL** – Index of Environmental Sensibility  
**ITLOS** – International Tribunal on the Law of the Sea  
**IUCN** – International Union for Conservation of Nature  
**C** - Survey Plan of the Brazilian Continental Shelf  
**LME** – Large Marine Ecosystems  
**MAB** – Man and the Biosphere Programme  
**MARPOL** - International Convention for the Prevention of Pollution from Ships  
**MER** – Marine Extractive Reserve  
**MMA** - Ministry of the Environment  
**MN** – Natural Monument

**MPA** – Marine Protected Area  
**MSP** – Marine Spatial Planning  
**NGO** – Non-Governmental Organisation  
**NPPA** - Strategic National Plan on Protected Areas  
**PAF** - Federal Action Plan for the Coastal Zone  
**PARNA** – National Park  
**PEGC** - State Plan for Coastal Management  
**PGZC** - Plan of Coastal Zone Management  
**PMGC** – Municipal Plan of Coastal Management  
**PNAP** - Strategic National Plan on Protected Areas  
**PNC** –National Contingency Plans  
**PNGC** –National Plan of Coastal Management  
**PNMA** - National Environmental Policy  
**PNRM** National Policy for Sea Resources  
**POA** – Annual Operative Plans  
**PRNP** – Private Reserve of Natural Heritage  
**PSRM** - Sectoral Plan for Sea Resources  
**RDS** – Sustainable Development Reserve  
**REBIO** – Biological Reserve  
**REMLAC** - Assessment Programme on the Mineral Potential of Brazilian Continental Shelf  
**RESEX** – Extractive Reserve  
**REVIZEE** - Assessment Programme on the Potential of Sustainable Capture of Living Resources in the Exclusive Economic Zone  
**RF** – Fauna Reserve  
**RQA-ZC** - Report on Environmental Quality of Coastal Zone  
**RVS** – Wildlife Refuge  
**SAO Charts** - Environmental Sensitivity Mapping for Oil Spill on Coastal and Marine Zones  
**SEAFO** - South East Atlantic Fisheries Organization  
**SEDR/MMA** - Secretary of Sustainable Rural Development from the Ministry of the Environment  
**SEMA** –National Secretariat for the Environment  
**SIGERCO** - Information System of Coastal Management  
**SMA-ZC** - System for Environmental Monitoring of Coastal Zone  
**SNUC** - National System of Protected Areas  
**SPU** – Department of Union Properties  
**SUDEPE** - Superintendência do Desenvolvimento da Pesca  
**UC** – Conservation Units  
**UN** – United Nations  
**UNCED** - United Nations Conference on Environment and Development  
**UNCLOS** - United Nations Convention on Law of the Sea Conference  
**UNEP** - United Nations Environment Programme  
**UNESCO** – United Nations Educational, Scientific and Cultural Organization  
**UNFCCC** - United Nations Framework Convention on Climate Change  
**ZATRI** – Tri-dimensional Marine Zoning  
**ZEE** –Ecological Economic Zoning

## 1. INTRODUCTION

### 1.1. Scope of the project

The coastal zones have been the most important and intensely used areas in the world, hosting the major part of global population and some of the most productive economic sectors (Kay & Alder, 1999). Coastal zones have traditionally been a place of high priority interest to people, to a variety of commerce and industries, to military, tourism and recreation aims, clearly composing a scenario of multiple, intense and often competitive uses (Clark, 1995). Beyond the coast, the sea has also becoming increasingly disputed, whose intensification and diversification of exploration has been allowed by technological developments and guided by strategic interests of nations (Cicin-Sain & Knecht, 1998).

The first problematic evidence has been the concentration of coastal population worldwide. In 1993, the world's population in coastal areas was equal to the entire global population in the 1950s (Beukenkamp *et al.*, 1993 *from* Kay & Alder, 1999). Presently, the United Nations Environment Programme (UNEP) estimates that about 40% of the world's population lives within 100 kilometres of the coast (UNEP, 2006). In 2020, around 75% of global population are expected to be settled in the first 60 kilometres of the coast (Edgren, 1993 *from* Kay & Alder, 1999).

Furthermore, the presence of valuable resources such as living marine resources (e.g. fisheries and diverse marine organisms), hydrocarbons (e.g. oil and natural gas), mineral reserves (e.g. gold, placer deposits, manganese nodules) and more recently, the possibility to extract part of the ocean energy (e.g. tidal power, ocean thermal energy, installation of wind turbines) have exacerbating conflicts of interests and rising questionings for an equitable resource allocation, including coastal and marine resources as foremost issues of strategic planning and management (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999).

As population density and economic activities in the coastal zone increases, pressures on coastal ecosystems also tend to increase. Due to such intensity of use, the consequences to the basis of natural resources have be regarded as catastrophic in many cases worldwide (Clark, 1995). Environmental modification and deterioration has been caused by continuous expansion of urban infrastructure, coastal industries, coastal forestry, tourism and second-home subdivisions, aquaculture, agricultural practices in coastal watersheds, dredging and dredge spoil disposal, sewage disposal, oil and gas exploitation – activities that are just some of development pressures over coastal and marine environment (Clark, 1995; UNEP, 2006; Sorensen, 2002).

Beyond the consequences of current development patterns, natural hazards and risks associated with climate changes are expected to have profound impacts on the functioning of ocean and coastal ecosystems, posing real threats to the welfare and security of coastal population (GOC, 2008)<sup>1</sup>. For that reason, the foremost recommendation to coastal nations lies in development of

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<sup>1</sup> Global Forum on Oceans, Coasts, and Islands, 2008. Strategic Oceans Planning to 2016. Working Group on Climate, Oceans, and Security- Policy Brief.

response mechanisms to deal with risks and uncertainty in marine and coastal areas, which requires modification of the prevailing forms of coastal use and settlement also demanding adjustments in the nature of coastal and ocean management currently performed. By empowerment of self-governance and cooperation across borders and sectors, prioritisation of capacity building, enhancement of response strategies and all-embracing coastal and ocean planning, risk management are expected to be more properly addressed.

Face to this background, the discussion on techniques and approaches to more adequately cope with coastal and ocean planning and management has becoming increasingly important (Kay & Alder, 1999). Clark (1995) describes the substantial scope of planning necessarily involved in any coastal and ocean-based efforts:

*“Coastal planning refers to a process of comprehensively studying resources, economic activities, and societal needs, including problems and opportunities in the designed coastal planning area, or coastal zone, and proposing future actions. The important purpose of planning is to examine the past and the present so as to choose the best outcome for the future” (Clark, 1995: p.28).*

Development of specific planning and management initiatives – either in broad or operational scale – has been the commonest response by governments to the variety of issues faced in the coastal zones (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999). Usually, the primary initiative of governments is to compose an economic development planning, aiming to strength coastal economy through promoting an optimum mix of uses, being devoted, in more or less intensity, to the enhancement of social welfare of coastal population. Nevertheless, economic development invariably means extension/ intensification of infrastructure, waste disposal, water supply projects, settlements, whose impacts are frequently not accounted or mismanaged in the planning process.

In contrast, when governmental action is focused on resource management and development control, such as natural hazards management, biodiversity maintenance, environmental assessment and pollution control, the initiatives are often performed in a disarticulated way, as sectoral issues handle in a subject-by-subject basis. This situation has been broadly recognised as completely inefficient at solving complex coastal zone problems (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999).

In that regard, the authors point out that the traditional administrative systems established in sectoral lines is the primary obstacle to an effective allocation of financial and human resources to coastal management. They also explain that sectoral-based system of government is designed to address management issues focus on specific activities’ sector, such as energy, transport, health, environment (op.cit), with similar conduct also with respect to ocean uses planning (Ehler, 2008). Therefore, instead of focus on a particular geographic area (e.g. coastal area, exclusive economic zone, etc) or on the range of pressure operating in that place, the planning attention is usually driven by specific demands faced by individual sectors, which also tend to lead to a complete division of the management of land and ocean issues.

In fact, coastal management responsibilities usually change when the focus is given to landward or seaward affairs, although prevail the involvement of a variety of jurisdiction, authorities and regimes of property, often with unclear or overlapping borders (Clark, 1995; Cicin-Sain & Knecht, 1998). Whilst coastal land is often owned/ managed by a multiplicity of bodies – governmental, private, corporate and also communal institutions-, the coastal waters are often exclusive responsibility of federal (or state) governments, whose jurisdiction has a legal extension internationally defined.

Such distinction, however, is not a recent conception; coastal and ocean matters have been historically handled in separated fields. Cicin-Sain & Knecht (1998: p.37) explain that coastal management has focusing primarily on coastal-sea interface and on approaches and methods to controlling the uses of coastal land, whereas the use and management of ocean areas under national jurisdiction have prioritising promotion, regulation and governance of ocean uses.

The authors complement that traditionally, “ocean” management were limited to address themes such as the extent of nation’s maritime zone, issues of maritime boundaries among nations, freedom of navigation and conservation of highly migratory species. In this case, the responsibility was often of national governments, particularly of foreign ministries, specialised fisheries and maritime agencies, such as maritime transportation and ports, and occasionally, was also matter of interests of military agencies such as naval departments (op.cit).

On the contrary, coastal management has its origins linked to the land side of the coastal zone, addressing issues related to the interface between the land and the sea, such as shoreline erosion measures, protection of wetlands, siting of coastal development and public access to the coast. In that case, due to the focus on control and regulation of coastal land, the responsibilities were divided through planning-type agencies at variables provincial and local levels of government, sometimes also involving national level interventions (Cicin-Sain & Knecht, 1998).

Presently, is of common agreement that integrated and multi-sectoral resource planning and management is specially needed in coastal zones both in its terrestrial and marine components (Cicin-Sain *et al.*, 1996; Cicin-Sain & Knecht, 1998; Kay & Alder, 1999; GOC, 2008). Nevertheless, is also well-known that it is not an easy task. Despite the inexistence of a single framework that perfectly fits to all range of ocean and coastal issues; integrated planning and management has becoming widely accepted concepts, being integrant part of the most comprehensive international prescriptions on the theme.

To address the land side of the coastal zone, including the interface between the land and the sea, the Integrated Coastal Zone Management (ICZM) is being increasingly consolidated in its scope and content, composing the broadest international strategy of action for coastal areas (Clark, 1995; Cicin-Sain & Knecht, 1998). And despite the historical divergence in the management of ocean and coastal affairs in most nations, the trend in the last two decades has exactly to centre the attention in the interconnection between coastal and marine uses, processes and mutual influences, developing integrated programmes, plans and actions.

On the ocean side, although planning and management of multiple uses of marine space is regarded as an evolving idea (Ehler, 2008), increasing attention is being placed on the potential of Marine

Spatial Planning (MSP) as methodological approach which has made the management of sea uses a reality (Douvere, 2008). MSP has showing confirmed ability to influence the location in space and time of sea-based human activities, therefore, encouraging compatibility of interests, avoiding conflicts among uses and reducing impacts of current and potential uses on the marine environment (Douvere *et al.*, 2007; Gilliland & Laffoley, 2008). Despite the acknowledge of economic, ecological and administrative benefits of MSP approach to ocean planning and management - which has been implemented in various coastal states worldwide - governments and ocean managers have facing the challenge of reduced information and discussion on how to put it into practice (Maes *et al.*, 2005; Maes, 2008). Furthermore, has also been noticed that MSP is just one part of a whole managerial process; hence, it integration with more comprehensive coastal planning and management is being increasingly recommended (Ehler, 2008).

In light of this background, the purpose of the present study is to investigate how these international trends have influenced ocean and coastal management in Brazil, mainly with respect to the adoption of ICZM and MSP concepts.

In practice, the objective is to describe how the task of integrating planning in costal and marine environments have been supported by international prescriptions, specially with concerns to the ICZM and MSP frameworks, introducing to a subsequently analysis of the state of Brazilian efforts in ocean and coastal planning and management. The study is based on the premise that recognise the links between policies and actions at international and national scales and share experiences are fundamental assesses to conduct to forthcoming improvements in a particular field of research.

The study gives simultaneous attention to theory and praxis of ocean and coastal planning and management, with the objective to underline how coastal and seaward issues are expected to be faced - in accordance with the international prescriptions - and how it has been in practice by examining the case of Brazil. The analysis of Brazilian outcomes in the theme is firstly made in terms of policy developments and instruments, later illustrated by description of some initiatives carried out in the country which have included the sea into the coastal management experiences.

The driving force for such multiple focuses - in policy, instruments and practices - is given by the lack of Brazilian literature that summarises these elements in an comprehensive analysis that also encompass the management of ocean issues rather than centring on coastal efforts.

In short, the present study intend to emphasise: i) how the Brazilian government is organised to deliver ocean and coastal planning and management initiatives throughout the country; ii) how marine and coastal affairs have been addressed by the range of techniques and instruments of planning and management currently available, reported and discussed worldwide; iii) how the national initiatives have incorporated the management of sea uses, to which array of interests they have responded and by which manner they have addressed the compatibility of multiple uses and conflictive sectorial interests; and finally, iv) to which extend the range of international prescriptions on ocean and coastal management have been incorporated by national policy and practices.



## 1.2. Objectives

The specific objectives of the present research are the follows:

- i) To describe the major international prescriptions on ocean and coastal management, with particular emphasis on frameworks of Integrated Coastal Zone Management (ICZM) and Marine Spatial Planning (MSP);
- ii) To identify the institutional and legal framework related to ocean and coastal management in Brazil, underlying its major principles and instruments;
- iii) To identify and describe the most relevant experiences of planning and management on ocean and coastal areas in Brazil, intending to examine how these initiatives have incorporated the management of sea uses and to which array of interests they have responded;
- iv) To analyse the Brazilian policies and initiatives on ocean and coastal management in compliance with the international prescriptions on the themes;
- v) To provide concluding remarks of the perspectives of improving coastal management and marine spatial planning in Brazil.

## 1.3. Methodology

In order to accomplish with the research objectives, the methodology of work was based on review of literature on the themes of interest, at international and national scale (Brazil), giving preference for official information make available by governmental bodies, later complemented by other trusty sources, such as accredited books on the field of ocean and coastal management.

The structure of the analysis is presented in the figure 1. The first part of the research is dedicated to a review of the *state of the art* on the main prescriptions on ocean and coastal management: the major concepts of planning and management were examined and some particularities of planning in coastal and marine areas identified. In sequence, the review research moved toward the international policy context on both environments - ocean and coasts – broaching their respective frameworks of management: the concepts of Integrated Coastal Zone Management and Marine Spatial Planning.

In turn, a second component investigates the Brazilian scenario on the theme – the *case study* component of this study. It began with a broad investigation of the political, social, economic and ecological spheres, aiming to identify the most significant environmental pressures on coastal and marine areas, which are, or should be, the driving forces for planning and management initiatives in the country. Afterwards, a systemic analysis of the Brazilian legal and institutional framework on ocean and coastal management was carried out. The major policies analysed were the *National Policy for Sea Resources* (PNRM) and the *National Policy on Coastal Management*, examined in its common developments, principles and objectives. With respect to the instruments of planning, all normative and technical-based tools foreseen in the ambit of coastal and marine policy were examined, and due to the importance of zoning as intermediary or final process of planning by itself, it deserved special attention, requiring an detailed explanation about the main procedures

involved in the Ecological Economic Zoning, the Brazilian expression this worldwide spread planning tool.

Besides these primary instruments, additional approaches which have supported planning and management initiatives in coastal and marine areas were identified during the literature research, being therefore, also analysed. Particular attention was given to Marine Protected Areas and participatory fisheries management – whilst the first case is grounded by a National System of Protected Area, participatory fisheries management have been implemented by a variety of institutional arrangement, but with increasing importance face to Brazilian socio-cultural reality associated with the use of ocean/coastal natural resources.

A third component comes in turn, distinguishing the *practical basis* of the study, where Brazilian management initiatives were analysed. The examination of the ocean and coastal policies focused on its mechanisms of integration in different domains: firstly, in handling ocean and coastal issues; then, at administrative level, seeking for integration among governmental sectors and bodies, and finally, also among government with science basis and society, expressed by means of direct involvement of research centres, universities and the public at large.

With regards to the instruments of planning, the study intended to compile the range of available information on the level of implementation of them nationwide. In a next step, priority was given to describe those initiatives which extended their planning and management efforts to the marine area, especially for those undertaken at federal level, namely, the Federal Action Plan for Coastal Zone and its derived programmes, particularly, the Priority Areas for Conservation of Biodiversity and the SAO Charts/Areas of Temporary Exclusion of Oil and Gas Activities, and finally the Macro-Diagnostic of the Coastal Zone.

In the scope of support instruments of planning at coastal and marine areas, the analysis centred in the case of Marine Protected Areas and participatory fisheries management, in both cases offering illustrative examples - the first tri-dimensional zoning approach in a Marine Reserve Island, and a case of how the use of spatial tolls have supporting and improving participatory management, though incorporation of traditional to scientific knowledge. In all the initiatives analysed – in the sphere of governmental programmes, protected areas or informal arrangements - the objective was to understand how the management of sea uses have been performed along with coastal issues and to evidence to which array of interests they have responded.

With the objective to improve the analysis of the major elements of Brazilian policies and initiatives on ocean and coastal management in compliance with the international prescriptions on the themes – one of the aims of the last chapter – three tables were organised, in which were summarised the main principles given by international prescription: i) firstly, in broad sense, concerning “good practices” on ocean and coastal management; ii) secondly, with respect to ICZM concepts; iii) finally, regarding MSP principles. Those rationalities were, so, compared with the theoretical basis and practical initiatives broached throughout this study, namely:

- Priority Areas for Conservation of Biodiversity and the SAO Charts/Areas of Temporary Exclusion of Oil and Gas Activities, developed in the ambit of the Federal Action Plan for Coastal Zone;
- Macro-Diagnostic of the Coastal Zone;
- Marine protected Areas, distinguishing no-take areas and Marine Extractive Reserves;
- Participatory fisheries arrangement.

Finally, concluding remarks are given on the future perspectives of coastal management and marine spatial planning in Brazil, according to the current state of the art on the theme.

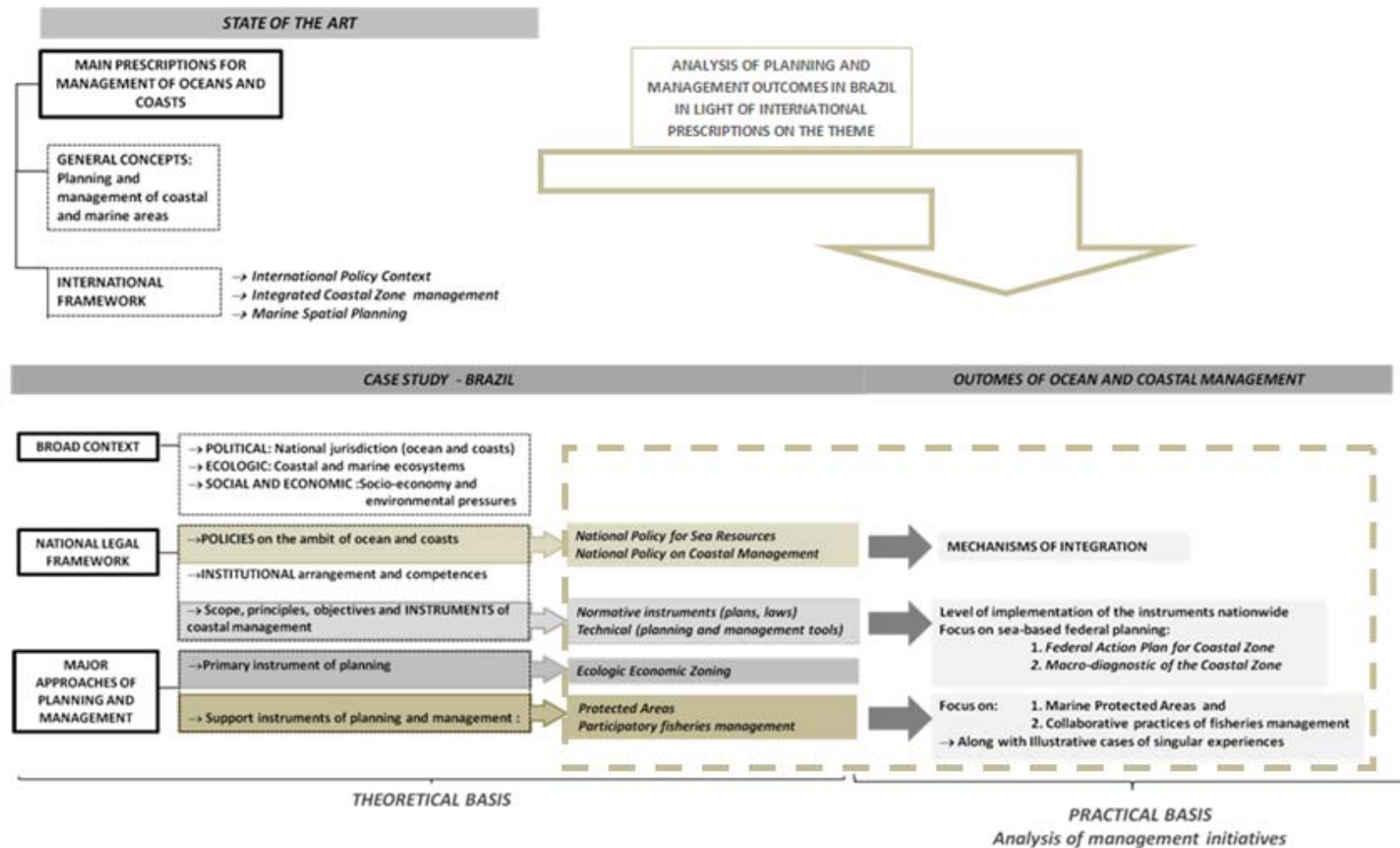


Figure 1 - Methodological structure of the research

### 1.4. Structure of the document

This introductory chapter aims to elucidate the scope and relevance of the study, as well as the objectives of such research. The methodological approach chosen is explained, and the structure of the document is presented.

Sequentially, the chapter 2 provides a review on the state of the art on the scope of international prescriptions for management of oceans and coasts. Planning and management concepts and practices on coastal and marine areas are described, introducing to the international frameworks for managing ocean and coasts worldwide: the Integrated Coastal Zone Management, as approach for handling terrestrial-marine interface issues, and the Marine Spatial Planning as recent purpose for sea uses' management.

The following section, chapter 3, introduces to the Brazilian context of managing coastal and marine areas. It provides an overview on the national jurisdiction on ocean and coasts, the existent ecosystems and resources, also pointing out the most important social and economic aspects of these environments and their major sources of pressures planning and management. Afterwards, the institutional and legal framework related to ocean and coastal management in Brazil is described. A chronological evolution of Brazilian policies in the theme shows the trajectory of legal integration among ocean and coastal domains, reaching the ongoing institutional arrangement on coastal management, its competences, principles, objectives and instruments. Later, the major approaches of planning and management on coastal and marine areas are reported, with a special section for the Ecological Economic Zoning, the primary instrument of planning, and also to additional support instruments of planning: i) the National System of Protected Areas (SNUC) and its practical application in planning and management marine areas and ii) fisheries regulation and management, analysing the purpose of participatory processes for managing resources.

In the chapter 4, the main outcomes of coastal and marine management initiatives in Brazil are described, showing the current level of implementation of the instruments of planning and management foreseen in the concerned policies, bring to discussion issues of integrated execution and effectiveness. The analysis on the coastal and marine planning integration focuses on three main experiences carried out at federal level: i) The Federal Action Plan for the Coastal Zone (PAF) and its developments; ii) the Macro-diagnostic of the Coastal Zone, and iii) Marine Protected Areas as instruments of planning at sea. Their recent achievements in national scale are pointed out, and in all cases, their respective spatial products of planning are presented, along with some discussion about the array of interests that they have responded.

The following section, still in chapter 4, examines collaborative fisheries management as additional mechanisms of conflict resolution at sea. The scope of co-management experiences in Brazil is introduced, along with a practical experience of mixing traditional knowledge and spatial tools for fisheries co-management. The objective is to exemplify how supportive instruments of planning have been able to cope with managerial issues involving ocean and coastal affairs, illustrating how diverse ocean and coastal management can be performed at variable scales.

The final part, chapter 5, presents a final analysis of the accomplishment of Brazilian policies and initiatives with respect to the international prescriptions on the theme: to which extend the major principles and instruments of planning have been incorporated, and how the task of integrating coastal and ocean issues have been performed. Some concluding remarks finalises the research objectives, highlighting the major strengths and obstacles still to overcome, as well as they future perspectives of incorporating, in integrity, the proposal of integrated coastal management and marine spatial planning in Brazil.

## 2. STATE OF THE ART: MAIN PRESCRIPTIONS FOR MANAGEMENT OF OCEANS AND COASTS

### 2.1. Planning and management of coastal and marine areas: concepts and practices

Management terminology is often regarded as overworked, resulting in a variety of terms often with overlapping scopes and meanings (Kay & Alder, 1999; Sorensen, 2002). Therefore, despite the variety of terms usually applied to refers to the practice of “managing the coasts”, such as “coastal zone management”, “integrated coastal zone management (and/or planning)”, “coastal area management (and/or planning)”, and “integrated coastal resources management” (and/or planning)”, the present study assumes that all those refer to a similar process whose objective is to promote an efficient coastal and marine management. Although some authors have assigned differences for such terminologies, the present study does not distinguish particular meaning for each concept and adopted the term of Integrated Coastal Zone Management due to its acceptance as an international framework.

In general, coastal planning can be performed in a variety of ways being dependent on the designed sector (e.g. economic or business planning) or on its objectives (e.g. land-use or development plans). Traditionally, the major focus has been on the terrestrial environment, whose scope and principles are being more recently extended to the ocean domain. In effect, planning and management are concepts whose ambits are readily adapted to a diversity of situations, demands and aims. In spite of such inherent flexibility, there are several characteristics that are inbuilt in the majority of plans summarising their substantial aspects (table 1).

Table 1 - Main variables distinguishing coastal management plans

<i><b>VARIABLES</b></i>	<i><b>TYPES OF COASTAL MANAGEMENT PLANS</b></i>
<b>Geographic Coverage</b>	International Whole-of-jurisdiction Regional Local Site
<b>Focus</b>	Strategic Operation
<b>Degree of integration</b>	Integrated Subject-by-subject
<b>Statutory basis</b>	Statutory Non-statutory
<b>Reason for plan production</b>	Direct response to management problems Required for funding Required to clear statutory works conditions Legislation which requires management plans

*Source: Kay & Alder (1999)*

With regards to geographic coverage or scale of planning, Kay & Alder (1999) explain that the aim of international plans is to regulate transboundary issues, creating a common purpose among nations, whilst whole-of-jurisdiction plans are expected to design administrative arrangements, to set national objectives and principles, and to point out priorities issues for individual nations. Regional plans, in turn, are those committed to translate the set of international and national goals and objectives to local outcomes, also aggregating local needs to the scope of such plans (op.cit). All three levels of planning are generally strategic in assuring alignment with broad guidelines and policies, at national and international sphere.

Local scale of planning involves issues such as engagement of local community, diffusion of information and raising public awareness (Kay & Alder, 1999; Cicin-Sain & Knecht, 1998). The most problem-focused order of planning is at site, usually involving detailed planning such as rehabilitation works, specific infra-structure, and for that reason, it is often regarded as level of planning where the results can be firstly seen.

In effect, the European Strategy for an Integrated Coastal Management (COM (2000) 547), launched in 2000, stresses the importance of ensuring compatibility and complementarity of planning at the various administrative levels. The document emphasises that integrated solutions to concrete problems of coastal management can only be effectively addressed if the higher levels of administration provide an integrated legal and institutional context, directing and aligning local and regional planning.

With respect to the focus of planning, Kay & Alder (1999) consider that the majority of initiatives invariably fall into two main types: strategic or operational planning, eventually combining both of them.

Strategic planning refers, according to the authors, to the highest order of planning, i.e. with broader scope, and concerns to issues involving long-term future development of the coast. It usually outlines the basis for elaboration of more detailed plans by providing broad objectives and defining the approach to be used, which will, in practice, guide the development of operational plans. Specifically to the coastal management, there have been identified two applicable levels of strategic planning: geographic focused, composing integrated area plans, and sector-based strategies, such as expansion of ports or coastal urban settlements, and so forth.

On turn, operational planning deals with day-to-day issues of coastal management, such as licensing or restoration actions, setting the specific objectives, directions and steps to perform such localised operations, detailing exactly how, when and where the activities must take place (Kay & Alder, 1999). In effect, both scales of planning are equally essential and complementary.

Subject- by-subject plans refer to initiatives that focus on a particular subject or sector involved in the coast management, such as fisheries management plans, coastal engineering and also industry-sector plans (op.cit.). On the contrary, integrated plan, also called area plans (Cicin-Sain & Knecht, 1998) are those that attempt to address conflicts and multiple uses issues of a given coastal area (e..g. estuary) by articulating various government sectors (e.g. harbours, transport, tourism, conservation of mangroves, etc). With such aim, integrated plans usually employ a variety of management approaches and planning tools (Kay & Alder, 1999). The authors observe that, in

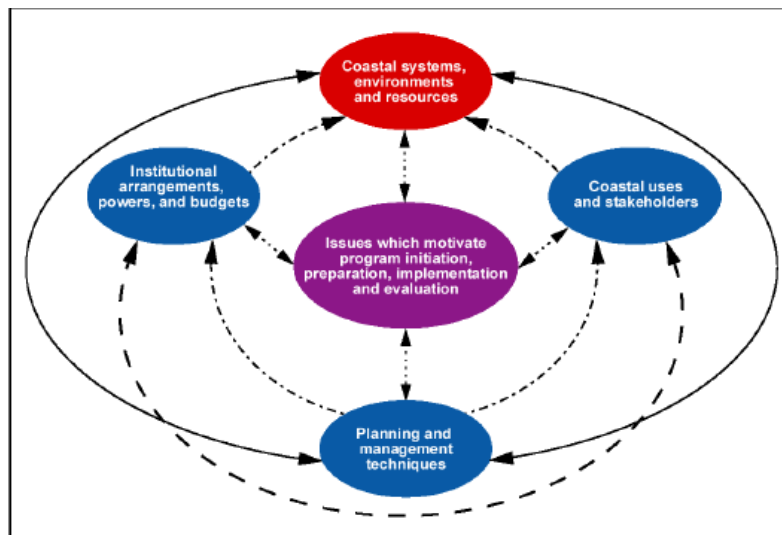


practice, many integrated plans have incorporating subject plans over the time, adding to the holistic approach specific sectoral demands.

The statutory or non-statutory basis refers to the formal power of a coastal management plan, i.e. if it is or not formalised by means of laws. The establishment of coastal plans by means of law is seen as an efficient way to overcome uncoordinated actions and conflicts related to jurisdiction, authorities and objectives involved in the planning (COM(2000)547).

Is also of fundamental importance to distinguish the requirements of coastal management plans, which refers to the reason why the plan has been done, besides the more obvious reason of to assist the management of issues and problems on coastal zone. Very often, planning efforts are direct response to management problems (Clark, 1995; Kay & Alder, 1998; Cicin-Sain & Knecht, 1999). Nevertheless, there have been identified some other frequent reasons for planning in the coastal areas, which may have strong implications in their overall shape and development (Kay & Alder, 1999). The authors explain that when coastal management plans have some external requirement, such as funding, legislation, or other, these requirements often pose constrains in some aspect of the plan, including its content, information needs, the format of the plan, who should be consulted, the timeframe for plan finalisation, or other steps that must be taken to obtain approval. In that sense, is a plausible risk that satisfying the constrains imposed on the production of a plan can impede or even override the practical issue of coastal management in a given area.

Sorensen (2002) have depicting the main elements involved in the management of coastal resources and environment, evidencing the interconnections among the natural system (coastal resources), social system (coastal users and stakeholders), political system (institutions and budgets); and technical system (planning and management techniques), all those guided by the main issues that have motivated the implementation of such management effort (figure 2).



Source: Sorensen (2002)

Figure 2 - Elements involved in the management of coastal resources and environment.

In effect, sound case studies have emerged worldwide showing how diverse the management and planning approach might be performed, and to what extent the planning and management techniques are effective to handle complex coastal and marine issues.

Kay & Alder (1999) have analysed some coastal management initiatives in variable scales<sup>2</sup>, particularly focusing on Asia-Pacific region, whilst presenting and discussing some of the major concepts and techniques of coastal planning and management, aiming to illustrate the diversity of coastal planning practices worldwide. The major coastal management and planning techniques identified by the authors are described in the table 2, classified according its administrative, social or technical emphasis.

Table 2 - Major coastal planning and management techniques.

<b>MAJOR COASTAL PLANNING AND MANAGEMENT TECHNIQUES</b>	
<b>Administrative</b>	Policy
	Legislation
	Guidelines
	Zoning
	Regulation permits and licenses
	Enforcement
<b>Social</b>	Traditional practices
	Collaborative and community-based management
	Capacity building
<b>Technical</b>	Environmental Impact Assessment
	Risk and Hazard assessment and management
	Landscape and visual resource analysis
	Economic analysis

*Source: Adapted from Kay & Alder (1999).*

The authors explain that administrative techniques are those in which governments directly assist the coastal planning and management, by encouraging through the use of policies or general guidelines. The authors complement that this rigid approach has higher potential when education and training programmes are also incorporated into a broad strategy of action. On the other hand, social dimension of coastal planning refers to the inclusion of other typed of values in the planning efforts, such cognitive, emotional and cultural perspectives (Kay & Alder, 1999: p. 132). Mentioned as an “afterthought choice”, social techniques are often employed in a complementary way, when is clearly understood that there are other significant issues that could improve the planning, such as traditional knowledge and practices, collaborative management, and so forth (op.cit). Finally, technical tools are those well-known and often widely applied in land-based systems, being adapted where necessary for application in the coast, and more recently, also in marine areas (Clark, 1995).

<sup>2</sup> Countries by planning scale analysed by Kay & Alder (1999): whole-of jurisdiction (Indonesia, Sri Lanka, Western Australia, Australia, United States, New Zealand); regional (Indonesia, United Kingdom); local (Sri Lanka) and site (Seychelles, Philippines, among others to exemplify some particular aspects of planning).

Cicin-Sain & Knecht (1998) have also carried out a survey in twenty-two selected countries<sup>3</sup>, called to answer a set of standard questions regarding the development of nation's efforts in coastal management. In this case, the discussion of each country's experiences has taken into account numerous factors not directly related to coastal planning and management. On the contrary, priority was particularly given to social, ethic and religious aspects; economic level of development; and political context of the country, such as type of government, concentration of power among national-level institutions and so forth. All these factors were expected to positively or negatively influence the effectivity to undertake an integrated process of coastal management.

Despite do not focuses on the diversity of methodological approach assumed, Cicin-Sain & Knecht (1998: p.182) identified a series of techniques and analytical tools that have shown potential to support decision made within a process of coastal planning and management, being already experimented and reported in the literature<sup>4</sup> as useful approaches for an integrated coastal planning and management:

- Resources inventories and environmental profiles;
- Mapping and Geographic Information System (GIS);
- Remote Sensing;
- Rapid Appraisal Techniques;
- Environmental Impact Assessment;
- Benefit-Cost Studies;
- Risk Assessment;
- Valuation of Resources;
- Habitat Assessment Techniques;

The authors also emphasise that decision making in various resources-based activities have been increasingly driven by economics, such as benefit-cost analysis and valuation of resources, being more recently adopted in guiding public investments, since its facilitates financial adjustments to available budgets. Nevertheless, has been internationally discussed the inherent limitation of assessing monetary value to the multiplicity of ecosystem's goods, services and to the natural capital (Costanza & Daly, 1992; Rojas & Aylward, 2003; Echavarria *et al.*, 2004; UNECE, 2007).

The range of others assessment techniques, such as resources inventories, mapping, rapid appraisal, and so forth, are regarded by its spread adoption both in early stages of planning efforts - grounding sound decision making - and to improve the assessment of management and performance (Cicin-Sain & Knecht, 1998).

As general remarks, both researches stress that regardless the range of techniques employed, is imperative to seek for integration among ocean and coastal issues, and also, among sectoral

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<sup>3</sup> Developed countries (Canada, The United States, The United Kingdom, France, The Netherlands, Spain, The Republic of Korea, Australia); middle developing countries (Brazil, Turkey, Thailand, Malaysia, Fiji); developing countries and countries in transition (Ecuador, The People's Republic of China, The Republic of the Philippines, Democratic Socialist Republic of Sri Lanka, The Federated States of Micronesia, Indonesia, the United Republic of Tanzania, Republic of India, The Islamic Republic of Pakistan).

<sup>4</sup> The authors suggest additional sources of information in each of these themes (see Cicin-Sain & Knecht, 1998: p. 182).

agencies and governmental levels of administration (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999). Furthermore, the authors underline the importance to tailor planning and management strategies in the coastal zone to the institutional and organisational environments of the country, including its political and administrative structures, economic conditions, cultural patterns and social traditions. Is also fundamental to understand the national-regional-local context and its intrinsic relation is an essential point to effectively plan and manage the diversity of marine and coastal issues.

In the ocean space, as the range of sea-based activities are becoming more complex due to the intensification of traditional sea uses and introduction of new maritime sectors (e.g. energy sources), conflicts related to marine uses also tend to follow such trend (Ehler *et al.*, 2009). In that sense, the guiding objective inbuilt in any coastal and ocean management must be the development of most compatible solutions, legitimising that all users and interests will be considered.

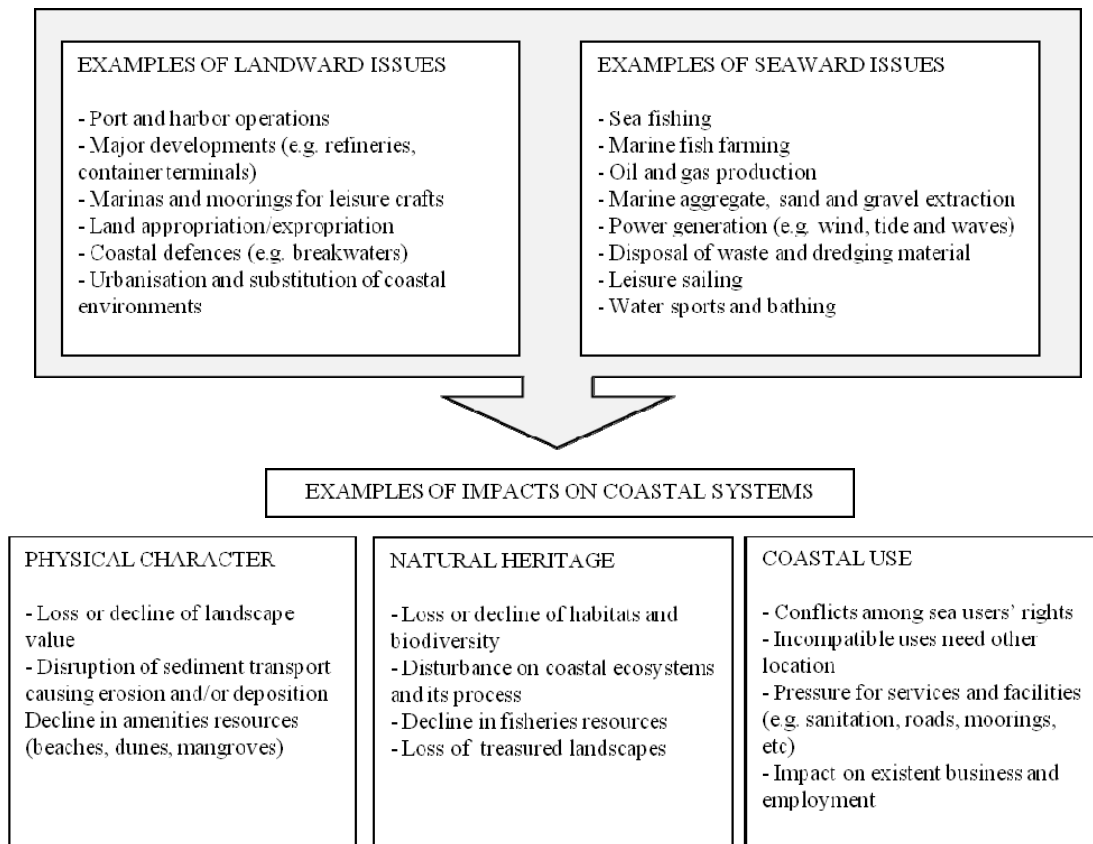
When the majority of coastal issues are seen as conflicts, the mechanisms for its management become strategies for conflict resolution (Kay & Alder, 1999). Nevertheless, the emerging conflicts are no longer limited to the impacts over coastal and marine environment; several types of interaction among uses have arisen, conflicting in a direct or indirect way. Cicin-Sain & Knecht (1998: p.19) indicate that conflicts related to coastal and ocean resources can be classified into three major types:

- I. Competition among users over the use (or non-use) of particular coastal and ocean area or resource, also reported as user *vs.* user conflicts (Douvere *et al.*, 2007);
- II. Adverse effects of one use on another use, such as oil development and fisheries, also described as user *vs.* environment conflict (Douvere *et al.*, 2007);
- III. Conflicts among governmental agencies with particular duties over coastal areas or which administer projects or programmes.

A synthesis of the multiple interests prevailing in landward and seaward affairs are represented in the following scheme (figure 3), underlying some of the major impacts on the coastal system, in terms of use's conflicts (user *vs.* user) and physical and natural losses (user *vs.* environment).

With respect to the conflicts at administrative level involving governmental agencies engaged with projects or programmes in coastal areas, they are intrinsically related to the multiplicity of regimes of property rights which implies in different authorities and responsibilities over the management of a given space and its natural resources (Clark, 1995; Cicin-Sain & Knecht, 1998).

In that regards, administrative arrangements for coastal planning and management are seen of fundamental importance for long-term survival of the initiatives undertaken (Kay & Alder, 1999). According to the authors, improvement of administrative arrangements goes beyond of organising governments to promote integration and coordination between agencies and levels of governance for coastal management. It is also central to link government with the private sector and the wider community in developing and implementing planning and management actions (op.cit).



**Source: Kay & Alder (1999) based on United Kingdom Local Government Management Board, 1995.**

Figure 3- Examples of landward and seaward management issues and major impacts on coastal systems

In effect, participatory planning aims to incorporate the perspective of all relevant stakeholders (maritime interests, recreational users, fisher workers, coastal inhabitants, and so forth) into the planning process. The literature has stressed that are several the benefits of collaborative process of decision making, such as improved identification of management issues and most conflictive affairs, support of local knowledge and practices, builds commitment and shared responsibility, hence, it is expected to result in more feasible decisions, based on real priorities of distinct social and economic groups (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999).

With respect to organising coastal management governance, Kay & Alder (1999) calls attention to two main factors that effectively differentiate the governmental approaches chosen to conduct and control the range of coastal activities, characterising particular types of administrative arrangements:

- **Networked:** when existing governments and sectors remain, as well as national policies, therefore, the focus is given to integration among ongoing agencies and legislation, and no specific coastal policy is enacted.

- Legislative: when new specific coastal legislation is created, but the foundation of new institutions is not mandatory - in some cases, preference is given to enabling of existent ones.

The authors stress that the creation of specific coastal management legislation, or coast-specific sections of broad legislation, can be particularly useful to assist planning and management initiatives in a variety of ways. There has been quite often to enact a legislation to define shape and content of a coastal programme, also designating a coordination body or lead agency aiming to promote the expected integration among levels of government and its sectors of administration.

Regardless the instruments chosen and institutional arrangements designed, any coastal planning must ensure coherence between legal instruments and administrative objectives, and also between planning and management. Besides such cohesion and the range of other characteristics hereby discussed, there are still some particular points to be taken into account when planning either at coastal or marine areas due to the existence of international framework on such themes. For that reason, the major principles assumed by the Integrated Coastal Zone Management and Marine Spatial Planning are examined in sequence, after a brief introduction to the international policy context on ocean and coastal management.

## 2.2. International framework on ocean and coastal management

### 2.2.1. International Policy Context

The use of maritime space and its resources has longer been a matter of economic and political interest, especially due to the greater importance of sea in the development of coastal nations, firstly centred on navigation and fisheries purposes (Cicin-Sain & Knecht, 1998). Nevertheless, the notion of the “Freedom of the Oceans” was graduated been substituted by the perception of the importance of ocean space and its resources, which took place especially after the end of The Second World War in 1945 (Cicin-Sain & Knecht, 1998; UN, 1998). At this time, several coastal states claimed for a legal jurisdiction over the maritime area adjacent to their shoreline aiming to guarantee their sovereign for exploitation of various offshore resources, such as oil, minerals and fisheries stocks (UN, 1998). Furthermore, the growing threats posed by oil pollution and dumping of waste into the ocean and related consequences for coastal states and navigation safety have triggered the international discussion about the use’s rights of the ocean (op.cit).

Consequently, the first meeting devoted to discuss a common regulation for ocean governance occurred in 1958, being known as first United Nations Convention on Law of the Sea Conference<sup>5</sup> (UNCLOS), sponsored by the United Nations (UN, 1998). A subsequent conference occurred two years later and then, it returned to the international agenda only in 1973. In this occasion, an agreement was achieved; nevertheless, only in 1982 the Law of the Sea (LOS) was legally launched, but it effectively came into force twelve years later, in 1994, after ratification by the majority of world nations (Cicin-Sain & Knecht, 1998).

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<sup>5</sup> The full texts of the Convention are available at: <http://www.un.org/Depts/los/>

Since then, the Law of the Sea - UNCLOS or just LOS - has been considered the “international constitution” for ocean governance, instituting the fundamental principles for sea exploitation, including the right to allocate activities and the duty to protect the marine environment (Maes, 2008). The law, composed by 320 articles, have introduced innovative principles and setting limits that have changed the ocean management perspective worldwide.

As basic principles, the ocean was formally recognized as *common heritage* of mankind and was firstly proposed the *integrated management* as new regime for marine scientific research and framework for technological cooperation and development (Churchill & Lowe, 1988). And whilst exercising their sovereign rights promulgated by such law, all states held the obligation of protection and preservation of the marine environment, assuming the duty to adopt laws, regulations and other measures to prevent, reduce and control all type of pollution, from land-based sources or sea-bed activities; from dumping in the ocean, vessels or others.

*“UNCLOS have had a determining influence on the recognition by all countries, and particularly the developing countries, of "a marine dimension" in their development policies. Governments have become aware not only of the importance of ocean space and its resources, but also of the close interdependence which exists between the different uses of the sea, imposing the need to adopt "integrated marine policies" (FAO, 1987<sup>6</sup>).*

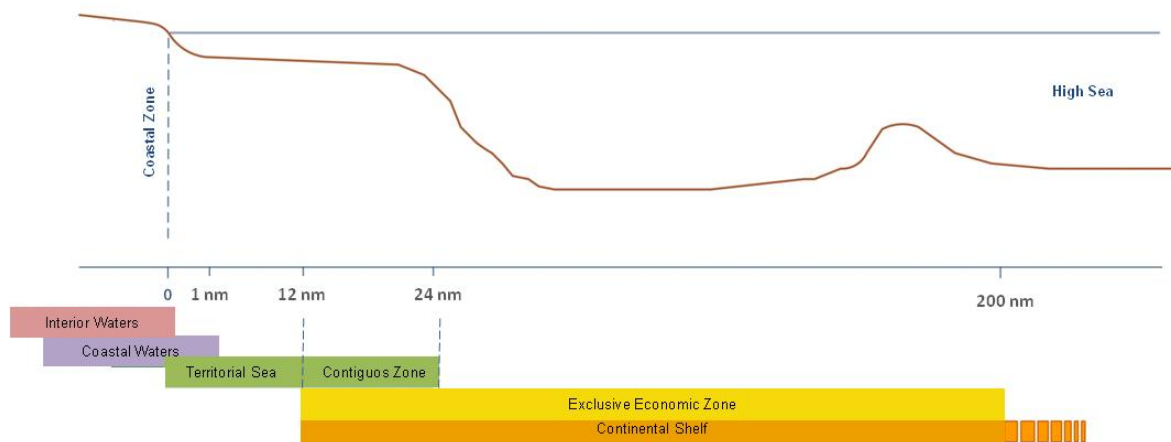
At total, the UNCLOS have defined seven maritime areas in which coastal states might exercise jurisdiction, which means promulgate legislation and enforce it, with respect to allocation of sea-based activities, exploitation and/or protection of marine resources (Churchill & Lowe, 1988). The most important jurisdiction limits set by UNCLOS, corresponding to particular state's rights, is depicted in the figure 4. Out of these areas, 200 nautical miles (nm) away from coastal strip, called High Seas, was instituted a particular regime in which no state can unilaterally claim sovereignty or sovereign rights and where the principle of freedom of navigation prevails (Maes, 2008).

Among others, the most relevant achievements of UNCLOS reported in the literature of ocean management were (Churchill & Lowe, 1988; Cicin-Sain & Knecht, 1998):

- The legitimacy of 200 nautical miles of Exclusive Economic Zone, over which the concept of “sovereignty” was founded;
- The establishment of 12 nautical miles as the maximum width of Territorial Seas;
- Navigation freedoms was protected and its principles well-defined;
- The Seabed Authority Committee was instituted, to regulate oil, minerals and other resources exploitation.

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<sup>6</sup> Food and Agriculture Organization of the United Nations - FAO Essays in memory of Jean Carroz. “The Law and the Sea: The adoption of Marine Policies by Developing countries”. FAO Corporate Document Repository - Fisheries and Aquiculture Department. 1987. Available at: <http://www.fao.org/docrep/s5280T/s5280t0p.htm#the%20exclusive%20economic%20zone:%20a%20historical%20perspective>



*Source: POEM - Plano de Ordenamento do Espaço Marítimo, Portugal.*

Figure 4 - Extend of Coastal Waters, Territorial Sea, Contiguous Zone, Exclusive Economic Zone and Continental Shelf defined by UNCLOS.

In effect, although international discussions have evolved first and particularly concerned with ocean affairs, holding a political dispute for jurisdiction before the environmental concern itself, it was later connected to environmental issues as a whole, extending the scope of integration already proclaimed (Churchill & Lowe, 1988; Cicin-Sain & Knecht, 1998). And according to the authors, despite the UNCLOS have provided a basic framework to cope with international conflicts on ocean resources exploitation, a more detailed guidance concerning the management approaches required to deal with the complexity and importance of the marine habitats and functions were give later, in the 70's, when environmental concerns also began to arise in the international agenda.

The first evidences about the effects of pollution on human health and on the environment - confirming the inescapable interconnections among ecological, economic and social systems - called attention to the urgency to adopt a *proactive* and *integrated approach* to cope either with coastal or marine management issues (Cicin-Sain *et al.*, 2006). The United Nations Conference on the Human Environment, held in Stockholm, in 1972, constituted the most comprehensive international commitment with the theme (op.cit)

As preparation for the Conference more than 100 countries elaborated environmental reports, which for Cicin-Sain & Knecht (1998) expressed the first comprehensive acknowledge of nations worldwide about the consequences of environmental degradation. The authors also point out that such wide-spread effort has lead to the establishment of permanent environmental departments or ministries in many countries, which came to be beneficial for forthcoming coastal and ocean management initiatives.



And even being primarily designed to deal with the environment in broad sense, the Stockholm Conference also devoted particular attention to ocean and coastal issues in a manner that the most important impacts of the conference were seen in those fields (Churchill & Lowe, 1988; Cicin-Sain & Knecht, 1998).

Twenty years later, the second United Nations Conference on environment occurred – The United Conference on Environment and Development (UNCED), better known 1992 Earth Summit or Rio 92, held in Brazil (Cicin-Sain *et al.*, 1996). At this time, the concerns were related to the evident interdependence of environment and development, face to the increasing recognition that industrialized societies were capable to significantly damage earth's climate and life support system, as well as the biological diversity and environmental. According to the authors, among the twenty-three listed objectives resulting from the Conference, of which nine were highlighted, one was particularly related to the ocean and coast:

*“Protection of the oceans, all kind of seas, including enclosed and semi-closed seas, and coastal areas and the protection, rational use and development of their living resources” (Rio Principles on Environment and Development, 1992).*

From the 1992 Earth Summit, Cicin-Sain *et al.* (1996) underline a clear growth in capacity for integrated coastal zone management. Among the developments pointed out, the authors emphasises that the ICZM concept was particular embraced as a central organizing concept in a number of sequential conferences and international agreements, which came to ratify nation's commitment with the theme all over the world. According to the authors, the major “outcomes” of 1992 Earth Summit were the following documents:

- I. Rio Declaration on Environment and Development;
- I. The Framework Convention on Climate Change;
- II. The Convention on Biological Diversity;
- III. Agenda 21;
- IV. A set of forest principles.

In effect, those developments in the international agenda gave rise to a multiplicity of efforts, in developed and developing nations, related to governance improvements and harmonization of coastal management with the set of agreements made (UNESCO; 2001; Sorensen, 2002). Therefore, a numerous of national police, regulations and other measures for environmental, ocean and coastal management have been formulated from 70's up to the present.

Nearly ten years after the UNCED, or Rio 92, a Global Conference on Oceans and Coasts occurred, with the aim of assessing the present status of oceans and coasts and progress achieved over the past decade (UNESCO, 2001). This document assessed important progress towards integrated and more sustainable ocean governance. Among the factors defending such constataion, the document presents a number of international agreements, voluntary instruments, and programs of action on oceans and coastal areas that have been negotiated and/or come into force in the last decade (ANNEX I). Furthermore, the document confirms that:

- i. There have been a numerous of new approaches to ecosystem management evolving (such as Large Marine Ecosystem) in which MSP can be certainly included;
- ii. New actions have been undertaken by national authorities; and
- iii. Considerable discussion on international mechanisms for cooperation on oceans issues has taken place.

The document also points out that the acknowledgement of linkages between terrestrial and marine environments has led to the proliferation of national and sub national efforts in integrated coastal management worldwide. Furthermore, there has been emphasised that improvement of ocean governance can be achieved through better communication, collaboration, and coordination of existing institutions and programs at the global, regional, and national levels rather than through the creation of new institutions (UNESCO, 2001: p. 11). As general remarks with respect to governance improvements and harmonization of international agreements, at regional and national level, the document outlines some worthiest recommendations (UNESCO, 2001: p. 14):

- Promotion of regional level ocean governance as an essential approach to pursue the sustainable development of oceans and coastal areas, to integrate global and local scales of governance, and to make progress toward ecosystem-based approaches;
- Promotion of regional and national multi-stakeholder frameworks or forum to address sustainable management of oceans and coastal areas in an ecosystem context, including the development of integrated frameworks for the planning and management of coastal, watershed and marine areas;
- Promotion of integrated implementation of relevant regional and global legal instruments, including those addressing trade and investment;
- Encourage at national and sub-national levels the creation of legal and institutional frameworks for the formulation and delivery of integrated policy on sustainable management of oceans and coastal areas, in order to focus the attention of decision-makers;
- With respect to transparency, participation and accountability in decision-making on oceans and coasts, promotion of informed decision-making at global, regional and national levels is recommended, giving preference to transparent participatory processes, based on scientific data, technical and local knowledge, and respecting cultures, customary law and current capacities.

However, the specificities of assessing and managing the marine environment are also recognised in the document, which emphasises the dynamism and complexity of the ocean, with several mechanisms yet poorly understood or even remaining to be identified (UNESCO, 2001). The focal point of such discussion is the fundamental role of oceans in determining the climate pattern by redistributing heat and freshwater around the planet - balance that has been threatened by pollution (predominantly from land-based sources) and overexploitation of marine resources (UNESCO, 2001). In light of such arguments, the document recommends “(...) *the need to detect and predict changes in the coastal ocean in a more timely fashion and with greater skill to meet the needs of integrated management and other applications*” (p.27).

It seems evident that high priority has been placed on advance of scientific monitoring and understanding of coastal and marine interconnections. As stronger is the linkage between science

and management efforts, more effective is expected to be the use and exchange of data and information, benefiting the ocean and coastal-based societies, sectors and the population as a whole.

In effect, despite the agreement about the major requirements for management of ocean and coasts, there are a set of traditional principles related to the “special character of ocean and coasts” which are particularly significant in complementing the desired rationality to guide forthcoming initiatives worldwide. Cicin-Sain & Knecht (1998) have retrieved<sup>7</sup> these major principles, grouping them into three main categories, namely:

***I. Principles based on the public nature of the ocean:*** The ocean has traditionally being a common resource, part of public domain, “(...) *not to be exclusively owned or benefited from by any one group or person*” (p.54), therefore, “(...) *managing resources as a commons should be preferred over privatizing such resources*”. And the authors completes that in case of benefiting private developments, the public should receive financial benefits derived from such investment (Clark, 1992).

***II. Principles related to the biophysical nature of the coastal zone:*** The coastal area is, by nature, a distinctive resource that requires special management and planning approaches, along with marine resources that are also highly distinctive: “(...) *the high mobility of marine resources and processes also makes traditional land-based management not altogether suitable for coastal area management.*” (Cicin-Sain & Knecht, 1998; p.55). Clark (1995) complements that: “(...) *the water influence not only establishes special conditions but also dictates unusual and complex institutional arrangements*”.

***III. Principles related to the use of coastal and ocean resource and spaces:*** These principles refer to the management of conflicts in coastal areas, providing some guidelines for use and public participation.

*“Generally, protection of living resources and their habitats should be given priority over exploitation of non-living resources; nonexclusive uses should be preferred over exclusive uses; and reversible exclusive uses should be preferred over irreversible exclusive uses.” (Van Dike, 1992; Archer & Jarman, 1992).*

Furthermore, new developments in the coastal zone that are water dependent (e.g. ports facilities) should have priority over those that are not, such as office buildings (Cicin-Sain & Knecht, 1998).

In light of such background, is reasonable to affirm that the major prescriptions for managing the oceans and coasts were already drawn in the international agenda, mainly with respect to its major principles, objectives and desired approaches. The specificities of management of each coastal domain – in its land and water environment – are given in sequence, aiming to underline their particular concepts and instruments of planning and management. Therefore, the objective of describe the major international prescriptions on ocean and coastal management, with particular

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<sup>7</sup> Cicin-Sain & Knecht (1998: p.54) have drawn the work of the following authors to list these major principles: Van Dike (1992), Archer & Jarman (1992); Clark (1992); Cicin-Sain & Knecht (1985; 1992) and Cicin-Sain, ed (1992).

emphasis on ICZM and MSP frameworks, will be achieved thus, concluding the panorama of international agenda on the theme currently prevailing.

### 2.2.2. Integrated Coastal Zone Management - ICZM

Although the first coastal management programme has been implemented in 1965, in the United States (Sorensen, 2002), the literature supports that the first prescriptions for an Integrated Coastal Zone Management (ICZM) was given by the Law of the Sea Convention (UNCLOS), in 1982, later improved by UNCED's Agenda 21, in 1992, when ICZM emerged as the designated framework for the realization of many of the goals of Chapter 17, officially called 'Integrated management and sustainable development of coastal and marine areas, including Exclusive Economic Zones' (Cicin-Sain & Knecht, 1998).

In this section of Agenda 21, coastal nations committed themselves to 'integrated management and sustainable development of coastal areas and the marine environment under their national jurisdiction.' Once more, the need for integration was emphasised along with other concepts, which later became the primary principles inbuilt in any ICZM process, such as: identification of existing and projected uses and their interactions; promotion of compatibility and balance of uses; the application of precautionary approach, including prior assessment and impact studies; and full public participation (Cicin-Sain *et al.*, 1996). A definition of the Integrated Coastal Zone Management given by Sorensen (2002: p.8) retrieves some of those aspects:

*“Multidisciplinary process that unites levels of government and the community, science and management, sectoral and public interests in preparing and implementing a program for the protection and the sustainable development of coastal resources and environments”.*

Clark (1995: p.20) definitions expresses the multiplicity of interests inbuilt in an integrated coastal zone management process:

*“Management of natural resources, conservation of biodiversity, maximization of socioeconomic benefits, and protection of life and property from natural (and induced) coastal hazards”.*

In effect, besides the Agenda 21, the contribution of Earth's Summit to the conceptual basis of the ICZM also came from the Rio Declaration, a document composed by twenty-seven principles intending to unify the rationalities inbuilt in national and international actions related to environmental, development and social issues (Cicin-Sain *et al.*, 1996). In broad terms, all principles lead to the concept of sustainability, which is the concept of balance among social, environmental and economic interests, also including the notion of time dependency and social justice. In the view of the authors, the most significant principles of Earth Summit (Rio Declaration) incorporated by ICZM were:

**1. Principle of interrelationship and integration:** Refers to the need to consider the interrelationship and integration inherent environmental protection and development, as well as among its multiples issues and sectors.

**2. Inter - and intra-generational equity principles:** Refers to the obligation of current generation to take into account the need of future users, especially regards to the distribution of the benefits (and burdens) of development; therefore, the current options cannot preclude the options of future generations.

**3. Environmental safeguard principle:** Relates to the prevention of environmental harm through anticipatory measures rather than posterior efforts to repair or provide compensation for it.

**4. Precautionary principle:** States that the lack of scientific certainty is no reason to postpone action to avoid potentially serious or irreversible damage to the environment.

**5. Polluter-pays principle:** Considers that the environmental costs of economic activities must be internalised by the sector rather than imposed on society as a whole.

**6. Transparency principle and other process-oriented principles:** Demand that decisions must be made with full public involvement, in transparent and open manner, with encouragement of participation by all groups (women, indigenous people, NGO's, etc), also requiring public's right to access to environmental information.

In spite of the absence of coastal focus in those principles, all of them make reference to particular obstacles to overcome inherent to the struggle between economic development and environmental conservation, which is in fact, the primary problem faced in coastal zone management worldwide.

Although such rationalities are expected to be incorporated within the development of an integrated coastal management programme, they did not specified how such recommendation could be achieved. In practice, the organisation of an ICZM has been supported by a set of phases broadly recognised in the literature (Table 3). One should note that it is a common path to the development of an integrated coastal plan regardless of some variations and needs for adaptation face to particularities of each nation with respect to its physical, socioeconomic, cultural and political conditions (Cicin-Sain & Knecht, 1998).

Is important to highlight that although the major purpose of the ICZM is to promote and efficient and equitable management of coastal and ocean resources, it does not directly manage the use of resources (Clark, 1995). The resources itself would continue to be managed by sectoral agencies committed with particular issues - such as fisheries, ports and water pollution - whilst the ICZM promotes the broad process of integration and coordination among inter-agency and inter-sectoral coordination, aligning their objectives.

Cicin-Sain & Knecht (1998) explain that it is the primary objective of an ICZM - to establish a process whereby government intervention can be organised and effective through programmes that aim to integrate the multiplicity of economic sectors, agencies and activities existing of users on the coast. And this is exactly the distinctive feature of the ICZM design, its multiple-use approach over the traditional sectoral (single use) approach, seeking for coordination and integration of existing

users underlying the need for broad participation and focused on harmonisation of conflictive interests. According to Clark (1995) such characteristics have significant legal and managerial dimensions, requiring a well-defined legal authority to undergird the range of regulatory measures that an ICZM contains.

Table 3- Steps to develop an Integrated Coastal Zone Management Plan

<i><b>Organising an Integrated Coastal Zone Management Plan</b></i>	
<i><b>Phases</b></i>	<i><b>Activities</b></i>
<b>Phase 1</b> <i>Identification and assessment of issues</i>	<ul style="list-style-type: none"> <li>• The need for management action is recognised for variable reasons (environmental crisis, deteriorating resources conditions, or perceived as an economic opportunity)</li> <li>• Consultative meeting with key agencies and stakeholders confirm the need for action, which must to be outlined in a concept paper</li> <li>• A team must be created to formulate an ICZM plan</li> </ul>
<b>Phase 2</b> <i>Planning and preparation</i>	<ul style="list-style-type: none"> <li>• Gathering of information on the biophysical, economic and social characteristics of the coastal zone as well as existing political jurisdictions and governance issues</li> <li>• A plan for public participation must be prepared</li> <li>• Management problems (causes, effects, solutions) and development opportunities are analysed (including new economic development opportunities)</li> <li>• Priorities are set for addressing problems and opportunities, taken into account technical and financial feasibility</li> <li>• Coastal management boundaries are set and management measures are considered (such as zonation schemes, strengthened regulatory programmes, market-based incentives, etc)</li> <li>• Institutional capacities and options of institutional arrangements are assessed (including inter-sectoral and inter-governmental coordination mechanisms)</li> <li>• Broad scope of the plan is prepared (goals, projects, monitoring and evaluation measures, etc)</li> </ul>
<b>Phase 3</b> <i>Formal adoption and funding</i>	<ul style="list-style-type: none"> <li>• Adoption of policies, goals, management measures, and initial projects (often by legislative actions)</li> <li>• Governance arrangements are establishment (integration mechanisms and coordination)</li> <li>• Staffing and organisation changes are put into effect</li> <li>• Funding arrangements are out into effect</li> </ul>
<b>Phase 4</b> <i>Implementation</i>	<ul style="list-style-type: none"> <li>• Governance body begins supervision of ICZM process and programme</li> <li>• New or revised regulatory programs come into effect</li> </ul>
<b>Phase 5</b> <i>Operation</i>	<ul style="list-style-type: none"> <li>• Individual sectoral agencies continue to perform their regulatory and management responsibilities but now as part of the overall ICZM programme</li> <li>• Specific objectives are designed and undertaken in connection with new economic opportunities in the coastal zone</li> </ul>
<b>Phase 6</b> <i>Evaluation</i>	<ul style="list-style-type: none"> <li>• A performance monitoring and evaluation programme is initiated</li> </ul>

*Source: Elaborated by the author, based on information of Cicin-Sain & Knecht (1998).*

According to recent survey undertaken by Sorensen (2002) about the status of integrated coastal management as an international practice, the major part of available literature specific in the theme consist of comprehensive guidance for ICZM. The other range of documents is related to provision of international guidance with focus on a particular topic, such as institutional arrangements, applied science and ICZM, and lessons learned. Nevertheless, the author confirms that *“the practice has developed a reasonably good understanding of the approaches, key principles and guidelines, frameworks and techniques for organizing and implementing programs and it is beginning to benefit from collective experience”* (Sorensen, 2002: p.48).

The author complements that due to this high level of generalisation found in ICZM, nations with a large length of coastal zone, characterised by diversity, in its expressions of development, natural features and resources - such as Brazil -- should consider preparing their own set of guidelines. In that regards, Cicin-Sain & Knecht (1998) considers that, beyond all benefits of tailoring the ICZM concept to fit the context of the country, the major importance of framing the proposal is to show that an ICZM process is not a threat to existing coastal management activities. Therefore is also recommended that the variety of sectors and user must be brining to the process as soon as possible, legitimise the planning and management intentions.

In Europe, a regional framework has been launched in order to support ICZM initiatives by Member States - Towards an European Integrated Coastal Zone Management Strategy, giving general principles and policy options (EC, 1999). The document has incorporated the general prescriptions given by the international policy into seven key principles for good management of Europe's coastal zones, as follows:

- Take a wide-ranging perspective (coastal and marine domains; natural, social and economic and political systems);
- Build on an understanding of specific conditions in the area of interest;
- Work with natural processes;
- Ensure that decisions taken today do not foreclose options for the future;
- Use participatory planning to develop consensus;
- Ensure the support and involvement of all relevant administrative bodies;
- Use a combination of instruments;

With respect to the results achieved in managing the coast, Cicin-Sain & Knecht (1998) have reported that in contrast to sectoral entities, the multiple-use approach of the ICZM allows that several important functions related to overall patterns of use, the well-being of marine coastal areas and harmonisation of interest can be contemplated. The table bellow describes the major finding of their research with respect to ICZM initiatives worldwide, in regards to the major function of the ICZM plans and what have been the typical initiatives undertaken (table 4).

Besides those major functions, the authors evidenced that ICZM plans have also seeking for protection of public safety (protect coastal population and properties from human-induced and natural hazards) and proprietorship of public submerged land and waters.

Table 4- Major functions of integrated coastal zone management efforts and typical initiatives undertaken by coastal nations worldwide

<b><i>MAJOR FUNCTIONS OF INTEGRATED COASTAL ZONE MANAGEMENT</i></b>	<b><i>TYPICAL ACTIVITIES UNDERTAKEN</i></b>
<b><i>Area Planning</i></b>	<ul style="list-style-type: none"> <li>Studies on coastal environments and their uses</li> <li>Zoning of uses</li> <li>Anticipation and planning for new uses</li> <li>Regulation of coastal development projects and their proximity with the shoreline</li> <li>Public education on the value of coastal and marine areas</li> <li>Regulation of public access to coastal and marine areas</li> </ul>
<b><i>Promotion of economic development</i></b>	<ul style="list-style-type: none"> <li>Industrial and artisanal fisheries</li> <li>Mass tourism and ecotourism</li> <li>Marine aquaculture</li> <li>Marine transportation</li> <li>Port development</li> <li>Marine recreation</li> <li>Offshore minerals</li> <li>Ocean research</li> <li>Access to genetic resources</li> </ul>
<b><i>Stewardship of resources</i></b>	<ul style="list-style-type: none"> <li>Conduct of environmental assessments</li> <li>Conduct of relative risk assessment</li> <li>Establishment and enforcement of environmental standards</li> <li>Protection and improvement of coastal water quality (point sources and non-point sources)</li> <li>Establishment and management of coastal and marine protected areas</li> <li>Protection of marine biodiversity</li> <li>Conservation and restoration of coastal and marine environments (mangrove forests, wetlands, coral reefs)</li> </ul>
<b><i>Conflict resolution</i></b>	<ul style="list-style-type: none"> <li>Studies of multiple uses and their interactions</li> <li>Application of conflict resolution methods</li> <li>Mitigation of unavoidable adverse effects on some uses</li> </ul>

*Source: Adapted from Cicin-Sain & Knecht (1998).*

With regards to the management tools employed, Cicin-Sain & Knecht (1998) underline the use of distinct techniques accordingly to the stage of the ICZM process. During the construction of information basis to subsidise the management process, resources inventories and environmental profiles, mapping and GIS systems, remote sensing, risk assessment, economic-based analysis and all others available are welcome to be used (p. 182). In the operation phase, zonation, set-back lines and exclusionary zones, protected areas, special area planning, mitigation and restoration and coastal permits are the most commonly applied approaches of management.

The authors also call attention to the fact that despite the use of zoning schemes to spatially separate uses is not necessarily integrant part of ICZM, it has been widely recommended in certain



situations to accomplish particular purposes - such has been the case of marine protected areas. In effect, zoning has showing immense potential as tool of coastal planning and management, being usually referred by its simplicity, flexibility of use and efficiency, being regarded as one of the most powerful and commonly used planning approach (Kay & Alder, 1999). In effect, multiple instruments have been employed in the scope of ICZM. The correct mix in a specific area will depend on the problems at hand and the institutional and cultural context of the nation.

In general terms, Cicin-Sain & Knecht (1998) have also emphasised the existence of some patterns of similarities among the variety of ICZM examined worldwide, such as:

- Problems faced by coastal and marine managers exhibits similar patterns in nations around the world;
- The evolution of each ICZM programme differ due to each nation's unique combination of geography, development issues, and political systems;
- In most nations, more than one level of government is involved in ICZM, with national government often having primary responsibility;
- It is difficult to assess the extent of implementation of ICZM, since there are yet little tangible evidences of changes of on-ground changes in human behaviour and status of coastal ecosystems;
- A similar set of ICZM tool and approaches is seen in many nations, which have choosing a combination of regulatory approaches, coastal and marine policy developments, planning processes, diagnostic of natural, social and institutional systems and participatory approaches to address particular use conflicts;
- The importance of external assistance for ICZM varies among countries;
- A movement towards greater integration (inter-sectoral, intergovernmental, spatial and interdisciplinary) is evident in recent years in many nations, by means of inter-agency coordination committees, local and national forum for discussion and many others.

In spite of several achievements reported, Sorensen (2002) confirms that the review of the literature on integrated coastal zone management shows that there are still potential barriers to be overcome when preparing and implementing integrated plans of any kind, particularly in developing nations, mainly related to:

- Deficiency of information data and predictability;
- Inherent difficulty to place socio-economic values on non-quantifiable benefits of environmental goods and services, which is a disadvantage, since they are compared with the other benefits or costs that are usually directly measurable and have evident political implications (e.g. employment, income generation), guiding public policy and decision-making not always to the "better direction" for the whole society;
- The disparity in the flow and appearance of costs and benefits over time, since the costs are usually immediate whereas the benefits very often takes many years to achieve visible results, which difficult the acceptance of the ICZM as a positive process, either for politicians or population;
- Vague and/or contradictory language in laws, decrees, or regulations that impede operational effectivity of the ICZM process;

- Over-reliance on the command-and-control approach for program implementation;
- Protection of private property rights by laws, constraining planning and implementation options;
- Weak cross-sectoral institutional arrangements, which are not able to cope with competitive strategies by sectors of government and their supporting stakeholders who perceive that ICM threatens their interests.

Furthermore, in the case of developing nations, there are a set of additional challenges underlined by Sorensen (2002). The dominance of relative small group of elites who control the majority of the nation's capital and productive land, mainly concerned with maximizing short-term profits, impede the establishment of decisions based on transparency and long-term objectives. Finally, many forms of political disruptions strongly influence all aspects of governance, particularly decisions made on the behalf of "the public interest" (op.cit).

A final and fundamental aspect involved in ICZM discussion lies on the issue of monitoring and evaluation, which is central for the success of any long-term management process, and has been reported as absent by the great majority of concerned literature (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999; Asmus & Kitzmann, 2004; Polette, 2008). The point is that a properly constructed evaluation is not only efficient to estimates the current performance of the programme, but also, to indicate the modifications or corrections required that will result in improved performance.

*“ The monitoring efforts must be sufficiently comprehensive to determine not only whether or not the goals are being meet but also, if they are or not, what has gone wrong with the assumptions or methodology so that appropriate midcourse corrections can be made” (Cicin-Sain & Knecht, 1998: p. 247)*

### 2.2.3. The purpose of Marine Spatial Planning - MSP

Marine Spatial Planning has originally began as marine management approach for nature conservation in the Great Barrier Reef Marine Park over 30 years ago (Ehler *et al.*, 2009), and nowadays, the need for MSP is introduced in various documents worldwide (Douvere *et al.*, 2007). Its application as tool for achieving multiple objectives in marine planning has been particularly motivated after international prescriptions for a more integrated management of ocean resources specially given by UNCLOS, the CDB, Agenda 21, Earth's Summit and has been also supported by international agreements in particular sectors, such as some conventions and protocols adopted in the International Marine Organisation, the FAO Conduct Code, and others (Douvere & Ehler, 2009).

In practical terms, marine spatial planning is a process of allocating the spatial and temporal distribution of human activities in marine areas, and it is expected to avoid or reduce user conflicts, by improving the management of marine spatial claims (Ehler & Douvere, 2007). The authors provide a definition of marine spatial planning, in its broadest sense:

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*“Analysing and allocating parts of three-dimensional marine spaces to specific uses or non-use, to achieve ecological, economic, and social objectives that are usually specified through a political process”.*

In effect, MSP approach sustains both environmental and economic intentions, aspiring to make reality the combination between the maintenance of the marine services and biodiversity, whilst also guiding a rational use of the economic potential of the oceans (Maes, 2008). However, it does not mean that that development activities occurring on marine space are unregulated - the situation is exactly the contrary; the range of multiples activities have been regulated by a variety of ways, through unsystematic and fragmented initiatives usually undertaken by individual sectors through permit-by-permit approach, instead of a comprehensive planning approach (Douvere & Ehler, 2009). In this sense, planning efforts have responded to immediate demands, and little attention has been given to anticipate conflicts or to evaluate cumulative effects of the excessive use of marine environment and its resources.

In international sphere, and more recently, the MSP approach has been encouraged particularly by UNESCO's Intergovernmental Oceanographic Commission (IOC) through the Man and the Biosphere Programme (MAB). The Commission has hold a Marine Spatial Planning Initiative, actuating by means of working groups with international experts in order to provide more detailed guidance for marine spatial planning and implementation, largely based on conferences and workshops discussion about MSP experiences worldwide (<http://www.unesco-ioc-marinesp.be/>).

The first practical result was a technical report launched in 2007 called “Visions for a Sea Change” (Ehler & Douvere, 2007). In 2009, based on important feedback on the content and utility of the work supported by UNESCO, the second report was released - “Marine Spatial Planning: a Step-by-step Approach Towards Ecosystem-based Management”, organised by the same authors. The purpose of this initiative was to clarify and unify the principles and guidelines for marine managers, composing a real manual to support development, implementation and evaluation of ecosystem-based marine spatial management, moving beyond its conceptual level (Ehler, 2008).

Independent of its scope, at international, European or national level, the concepts and principles embedded in MSP shall be the same one, since they are dealing with a common and transboundary resource - the oceans. Hence, the precautionary and ecosystem-based approach must be the primary rationality. Complementing the view given by the precautionary principle, already described, the MSP assumed the ecosystem-based concept of management, which emphasizes the protection of ecosystem structure and functioning due to the interconnectedness within systems and processes, and usually transcend arbitrary political and administrative boundaries (Ehler & Douvere, 2009). For that reason, the ecosystem must be the core component when planning actual and futures strategies for oceans uses. Additionally, to the ecological perspective must be integrated the social, economic and institutional aspects, and their strong interdependences must also be recognized (op.cit).

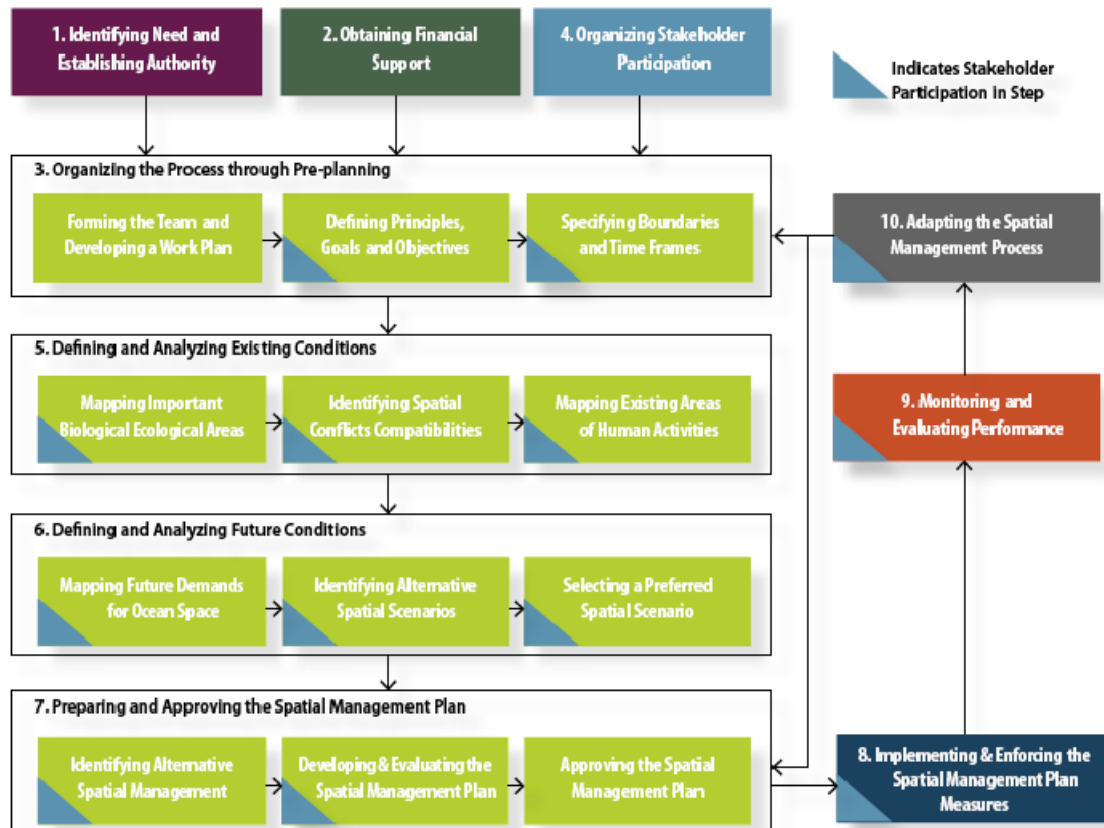
From that on, the specificities of planning tend to differ according to governmental demands and sectoral claims for sea space of resources, often resulting in variable combinations among uses, such as marine transportation and navigation routes, laying of submarine cables and pipelines, fisheries and marine recreation; oil/gas exploration and sand/gravel mining (Maes, 2008).

However, have been increasingly significant the claims for new uses of the ocean, as offshore renewable energy (namely wind farms), aquaculture, coastal defence structures and marine protected areas (Douvere & Ehler, 2008), being particularly relevant in seas shared by a numbers of developed countries, as is the case of the North Sea.

Independently of the driving force for MSP execution, its development and implementation is expected to involve a number of basic steps well-defined by the UNESCO initiative. It begins with the establishment of priorities, which will provide the basis for planning since they represent the development objectives of the government for that area (e.g. marine habitats protection, renewable energy sector development, etc). Another fundamental step is the definition of planning boundaries – which is not necessarily the whole maritime jurisdiction - and time frame period, suggested to be from 10 up to 25 years, or even more.

Going further, an overarching inventory must be prepared, being scientifically grounded, summing up the availability of marine resources (renewable and non-renewable), physical and oceanographic features of the area, besides the range of social/cultural uses and economic activities carried out, composing an extensive scenario of the existing conditions.

Then, considering the stated priority, the future conditions must be foreseen, usually made through the elaboration of future scenarios, estimating all or the most probable spatial and temporal requirements for ocean space demands. In practice, these scenarios aim to provide the idea of how the area is likely to look at the end of the period of planning, when preference is given for one or another alternatives and/or uses. The overall process is depicted in the diagram below, showing the main steps usually applied (figure 5).



Source: (Ehler & Douvere, 2009).

Figure 5 - Marine Spatial Planning steps recommended by UNESCO's Intergovernmental Oceanographic Commission

Subsequent steps involve the preparation and approval of the final spatial arrangement preferred, implementation and legal enforcement of the plan. Usually, the MSP has both a sea use planning and management dimension, and some of its key planning tools have been:

- Characterisation of uses (current /potential)
- Development of scenarios
- Zoning map;
- Geographic Information System;
- Matrix of compatibility of uses.

Mechanisms for monitoring and evaluating performance are also integrant part of the planning process, since it allows adaptation of the plan to newly developments in terms of knowledge, science and technologies that could change or even improve the use of maritime space and its resources (Maes, 2008).

The stakeholder involvement can occur in different phases of the process (depicted in the figure X). Ehler (2008) defends that early and continuous engagement of stakeholders is critical to the long-term success of the process, guaranteeing ownership of the process by the range of users involved.

Legal binding and political support are reported as important factors for the effectiveness of the planning and ideally, the MSP should be implemented as a statutory process, also requiring legal enforcement for the adoption of its final plan, being incorporated into current planning policies or launched as a new one (De Santo, 2009). Ehler (2008) calls attention to the possibility to integrate MSP with plans for adjoining coastal areas - terrestrial land-use plans - aiming to improve the engagement of land-based sectors of the economy that may have major implications for the marine sector (e.g. energy, transportation, etc). In effect, MSP and ICZM objectives and principles of planning keep close relations, which supposes that marine spatial planning can be easily incorporated in the management of the marine component of the coastal zone.

As occurred with the ICZM, the necessity of tailoring to the nation's demands and context has been also felt by MSP approach; hence, the alternative found was to legally bind MSP to regional policy, as European Community has already made.

In European Community the legal key instrument for addressing marine and coastal issues is the Integrated Maritime Policy (IMP) launched by the "Blue Book". It was established on 2007, as a result of simultaneous developments in two complementary although conflictive fields – the environmental protection and the improvement of the sea-based sectors (De Santo, 2009). Proposed by the European Commission, this policy expressed the clear recognition that all matters relating to Europe's coastal and oceans are interlinked, hence, an effective marine policy should be enough comprehensive face the challenges of globalisation and competitiveness, climate change, degradation of the marine environment, maritime safety and security, energy security and sustainability (COM (2007)575).

In order to accomplish with the principles of *Integrated Approach to Marine Governance*, among the major recommendations proposed by the IMP was that Maritime Spatial Planning should be implemented either exclusively for management of marine offshore areas or in the scope of an ICZM. According to the Blue Book, both instruments – MSP and ICZM - contribute to meet numerous of the international commitments and allows an improved predictability for the planning of future investments in maritime space (COM (2007) 575).

In Europe, the roadmap was the first guide launched with the intention to facilitates the development of MSP by Member States, encouraging its implementation and seeking for coherence among European countries initiatives regarding the management of transboundary resources (COM(2008)791). The key principles stated by the roadmap are the following:

- Using MSP according to area and type of activity;
- Defining objectives to guide MSP;
- Developing MSP in a transparent manner;
- Stakeholder participation;
- Coordination within Member States – simplifying decision processes;
- Ensuring the legal effect of national MSP;
- Cross-border cooperation and consultation;
- Incorporating monitoring and evaluation in the planning process;
- Achieving coherence between terrestrial and MSP – relation with ICZM;

- A strong data and knowledge base.

In 2009, after two years from the legal establishment of the Integrated Marine Policy and one year of the ROADMAP release, the Commission has published a Progress Report (COM (2009) 540), in order to summing up the achievements of the policy and designates the course for the next phase of the IMP.

Regarding Member States action, the report assess that there have been felt positive development in integrated approaches for marine planning, in terms of building administrative structure required for policy coordination of sea-related matters; creating additional activities in all relevant policy areas pursued where needed, both measures directed to support a broad and integrated intervention as is required for maritime management.

Furthermore, the report give credit to Member States initiatives towards the increasingly “sharing” component related to marine management implementation. Share experiences has been seen as key element for grounding and driving Members States decisions, also improving coordinated actions and resulting in higher quality of planning.

As result of this policy bidding, Europe concentrates the major number of worldwide MSP initiatives (table 5), and several authors have reported experiences on MSP, despite the early stage of evolution of the majority of initiatives (Ehler, 2008).

In practice, MSP have cope with controversial issues involving new uses of the sea and the seabed and with the imperative of marine biodiversity conservation. In Belgium, the need for MSP became urgent in light of new national objectives associated with increasing in offshore energy production (wind farms) and the necessity to meet the European Network on Protected Areas requirements (Natura 2000) (Douvere *et al.*, 2007). In the Netherlands, the competition for ocean space was subject of political debate for several years, being related with the development an offshore airport, industrial facilities, waste disposal and land reclamation demands (Douvere & Ehler, 2008). In Germany, the trigger force was the necessity to ensure management of conflicts that have emerged between the demands of new technologies (offshore wind sites), tourism and nature protection with traditional uses, such as marine transportation, fishing and defence (Gee *et al.*, 2004).

In general terms, MSP has showing potential to assist the countries to handle their internal conflicts, being in line with international agreements but also meeting their own needs. In practice, MSP have mainly responded to maritime claims of different sectors but being guided by strategic interest of the governments over maritime resources. These cases illustrate such trend being characterized by economic driven forces and expressing government decisions - what is expected for the North Sea, with high importance for different surrounding countries.

Table 5 - Marine Spatial Planning initiatives worldwide

MARINE SPATIAL PLANNING INITIATIVES WORLDWIDE		
<b>Oceania</b>	Australia	Marine Bioregional Plans Great Barrier Reef Marine Park
	Belgium	Master Plan for the Belgium Part of the North Sea/GAUFRE Project
<b>Europe</b>	Germany	Spatial Plan for the North Sea and Baltic Sea Spatial planning for the German coastal state waters of Mecklenburg-Vorpommern
	Norway	Integrated Management Plan for Barents Sea-Lofoten Area Norwegian Sea Management Plan
	Sweden	Marine Environment Inquiry
	The Netherlands	Integrated Management Plan for the North Sea 2015
	United Kingdom	Marine and Coastal Access Bill Irish Sea Pilot Project
<b>America</b>	Canada	Large Ocean Management Area Integrated Management Plans Eastern Scotian Shelf Integrated Management Plan
	United States	Florida Keys National Marine Sanctuary Massachusetts Integrated Oceans Management Plan
<b>Asia</b>	China	China Marine Functional Zoning of Territorial Sea

*Source: Elaborated by the author based on information from UNESCO Initiative on Marine Spatial Planning (available at: <http://www.unesco-ioc-marinesp.be/>)*

Although some countries have been already concluded its MSP efforts - such as Belgium– there is still a lack of rigorous evaluation of its practical experiences, firstly, due to the recent approval or implementation of such plans (Ehler, 2008; Douvere & Ehler, 2008). In fact, while some benefits can be seen quickly – such as avoidance of conflicts between new and existing uses, whereas environmental benefits can take years to show its results.

Regardless such practical evaluations, the benefits of MSP are of common agreement in the concerned literature and have show potential benefits in economic, ecological and administrative terms (Ehler, 2008). The economic benefits are related to the possibility to anticipate conflicts of uses; therefore, it stimulates the search for compatibility (spatial and/or temporal) among interests that might overlap or prejudice each other (op.cit.). It has been done by means of integration of information on the current uses across the seas with key features of marine areas that are (or not) demanded by particular sectors, which is really useful in selecting sites for specific activities, indicating if there is chance of potential conflicts between the future and current uses taken place in that area. In practice, it gives long-term provision for investment decisions, identifying the potential for a given sector before significant investments of capital. Is important to highlight that in ocean areas, “users” are essentially represented by sectors, private or public, whilst individual users or interests are restricted to the coastal areas.



In ecological terms, MSP benefits are related to its potential to focus on the whole marine ecosystem, its process and interconnections, evidencing the opportunities for biodiversity commitment through identification of particular areas of biological importance and high sensitiveness whilst also provides a general context for a representative network of marine protected areas (Ehler, 2008).

In regards to the administrative benefits, the author stress that MSP improves speed, quality, accountability and transparency of decision-making and better regulation. It reduces costs of information collection, treatment and analysis, since it joints these processes, providing the opportunities to assess a combination of multiples objectives and balance benefits and costs of management measures in a given area. In synthesis, MSP has shifting the focus of the management approach of marine areas from regulation and control to planning and implementation (op.cit).

Although the MSP concepts are now included on several policy documents and plans worldwide, its practical application is still prone to variable directions.

In effect, the current challenge faced by MSP initiatives, in practice, is basically conditioned to one main factor - the low ability to predict marine ecosystem behaviour. The implications of such limitation in knowledge about the marine ecosystem lead to several consequences, such as uncertainly about the feed-backs of pressures on the marine environment and its long-terms responses (cumulative effects) (Douvere *et al.*, 2007; Ehler, 2008; Douvere & Ehler, 2008). As consequence, it results in lack of practical information to support Marine Spatial Planning decisions with respect to criteria for conflict resolution based on potential impacts and interactions among sectoral activities (Ehler, 2008), also limiting cost-benefits analysis, because of the impossibility to give monetary values to the range of goods and services provided by the oceans (Douvere & Ehler, 2008).

Although conceptually well-grounded, the literature stress a lack of practical information to support Marine Spatial Planning decisions, particularly with respect to principles and criteria for conflict resolution related to spatial and temporal allocation of sectoral activities (Maes, 2008; Douvere & Ehler, 2008). According to Ehler (2008) what has still missing is a clear demonstration of how it can be implemented.

The final objective of the planning process is invariably to achieve a balanced result among environmental, social and economic demands; however, the plan must also fit to political objectives, being in line with international prescriptions and commitments. The positive aspect of incorporating the MSP into a broad integrated coastal planning is to ensure that the MSP will not conflict with major objectives of planning, also facilitating its legal bidding with coastal policies.

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### 3. MANAGING COASTAL AND MARINE AREAS IN BRAZIL

#### 3.1. Brazilian Coastal Zone: An introduction

Brazil is the fifth biggest nations of the world in terms of land mass and population and is primarily characterised by its diversity, in social, economic and environmental terms (<http://www.worldatlas.com>; Scherer *et al.*, 2009). The coastal areas have stand as the most densely occupied area of the national territory, also regarded as the most conflicting as well, experimenting the highest level of diversification and intensification of environmental pressures derived from expansion of coastal population and economies (Asmus & Kitzmann, 2004; Polette, 2008). This situation has lead to the perception of how important is the understanding of the coastal zones as an integrated system of noteworthy coastal and marine resources, whose exploration requires the development of tailored planning and management initiatives aligned with particular circumstances and demands (Cincin-Sain & Knecht, 1998).

In turn, the main features of the Brazilian coastal zone is described, in order to provide a general panorama of the socio-economic and environmental conditions of the country, giving rise to the first insights about the most demanding and desirable approaches to be undertaken by planning and management initiatives along national coastal and marine areas.

##### 3.1.1. National jurisdiction

Brazil, officially named República Federativa do Brasil (Federal Republic of Brazil) is located in South America, comprising around 47% of its territory with an area of 8,51 million km<sup>2</sup> (IBGE, 2002). Brazil holds a population of about 190 million people (IBGE, 2008). The country makes frontier with almost all South American countries - Venezuela, Colombia, Guyana, French Guiana and Suriname to the north; Bolivia and Peru to the west; Uruguay, Argentina and Paraguay to the south, and the Atlantic Ocean to the west.

The political division of the national territory is based on three hierarchical levels of administration, namely, federal, state and municipal governments. The Brazilian Institute of Geography and Statistics (IBGE)<sup>8</sup> recognise 26 states and one federal district - Brasília (figure 6, in the red square), and a total of 5,564 municipalities.

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<sup>8</sup> IBGE - Brazil in synthesis, Population data. Access on: 22/02/2010.



Source: <http://www.santaremtur.com.br/portugues/maps/maps.htm>

Figure 6 - Political Map of Brazil

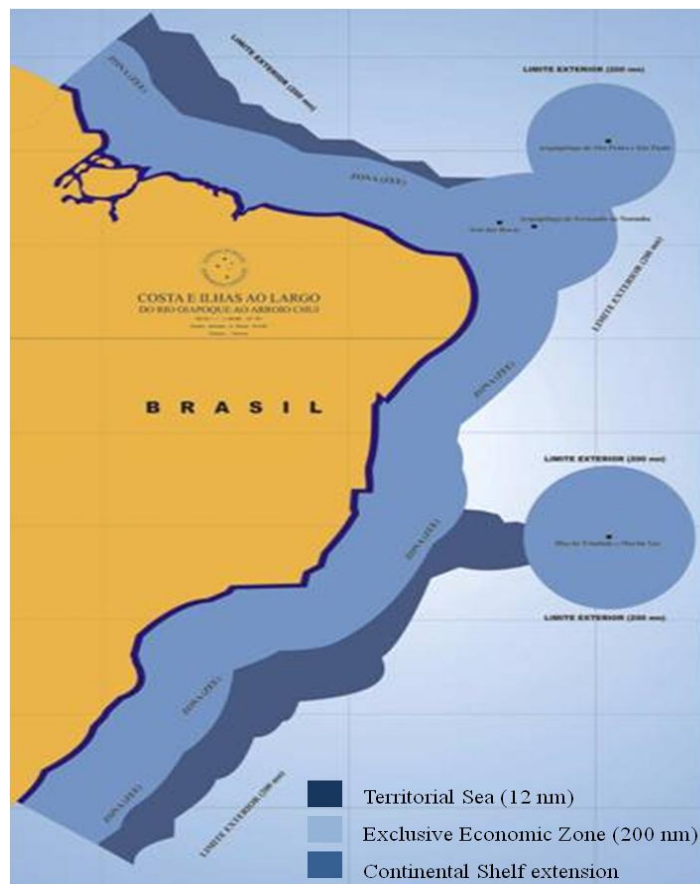
The Brazilian coastal zone extends for 8698 km<sup>9</sup> between latitudes 5°16'20"N and 33°45'04"S (Scherer *et al.*, 2009). The maritime frontier represents 32% of the whole national boundaries, almost totally included in South Atlantic Ocean only reaching the Caribbean Sea in the extreme north of the country. In terms of area, the coastal zone comprises approximately 514,000 km<sup>2</sup>, of which about of 324,000 km<sup>2</sup> correspond to the land component, while the rest refers to the Territorial Sea (MMA, 2008).

The maritime jurisdiction follows those limits internationally set by UNCLOS. The Brazilian Exclusive Economic Zone (EEZ) is also called "Blue Amazon", comprising an area of about 3,54 million km<sup>2</sup>, including coastal and oceanic volcanic islands such as Fernando de Noronha Archipelago, Trindade e Martin Vaz Islands, das Rocas Atoll, Abrolhos Archipelago and São Pedro e São Paulo Rocky islands (Torres & Hundrsen, 2005).

Nevertheless, in 2007 the Commission on the Limits of the Continental Shelf, linked to the UNCLOS, accepted the proposal of the Brazilian Government claiming for extension of its EEZ

<sup>9</sup> This figure includes all the reentrant areas, such as bays and estuaries. In straight line, the coastal zone totalises 7.365 km (Asmus & Kitzmann, 2004).

jurisdiction over the current limit, once was confirmed the extension of the Continental Shelf beyond 200 nautical miles (nm) (Torres & Hundrsen, 2005). Such constataction was given by a broad research programme called *Survey Plan of the Brazilian Continental Shelf* (LEPLAC - Plano de Levantamento da Plataforma Continental Brasileira), instituted by the Federal Government in 1989. The extension claim has been recently approved, adding about 900.000 km<sup>2</sup> to the Brazilian EEZ, which has reached 4,4 millions km<sup>2</sup> (MMA, 2008). The legal boundaries of the 200 nm EEZ and the additional area recently included in the maritime national jurisdiction are depicted in the figure 7.



Source: Navy of Brazil. Available at: [www.mar.mil.br](http://www.mar.mil.br).

Figure 7 - Legal boundaries of the 200 nm Exclusive Economic Zone and the extension of the Continental Shelf included under national jurisdiction

## 3.1.2. Coastal and marine ecosystems

The wide latitudinal distribution of the Brazilian coast implies in a diversity of oceanographic conditions and geomorphologic features (Absher *et al.*, 2002), which holds a variety of ecosystems

extending over 388.000 km<sup>2</sup> along the coastal zone (Asmus & Kitzmann, 2004). In a simplified description, the North region is characterized by the occurrence of muddy fields and mangroves; the Northeast by presence of sandy dunes, reefs fringe, parcels and deltas; the Southeast is dominated by estuaries and coastal lagoons and South region by coastal cliffs and lagoons (Knoppers *et al.*, 2002).

The most expressive occurrence is represented by mangroves, which cover about 25.000km<sup>2</sup> from latitudes 4°30'N to 28°53'S (Knoppers *et al.*, 2002). According to Scherer *et al.* (2009) such ecosystem borders over 92% of national coastline, extending for 6,800km along estuaries, lagoons and bays. Is also along the coastal zone where the largest residual Atlantic Forest can be found, in isolated spots or contiguous areas mainly along the Serra do Mar mountain ranges in Paraná, São Paulo e Rio de Janeiro States (MMA, 2008; Scherer *et.al*, 2009).

As result of different topography, currents, sediments and water masses the marine productivity is also variable (UNEP, 2004). The most productive regions is the North, where the Amazon River is the main source of nutrients, followed by the Southeast and South region, which depends upon multiple sources to maintain its productivity, such as estuarine systems, the Plata River, upwelling and intrusion of cold and rich waters. The Northeast lies as the less productive region, especially due to the impact of the South Equatorial Current (Knoppers *et al.*, 2002; UNEP, 2004).

The marine ecosystems worldwide have been assessed and reported in terms of Large Marine Ecosystems (LME), initiative developed in the scope of the Global International Waters Assessment<sup>10</sup> (GIWA). The marine areas adjacent to the continents have higher productivity compared to the open sea and represent a significant source of nutrients to the oceans (Knoppers *et al.*, 2002). According to the GIWA, the coastal waters are responsible for about 80% of annual marine fisheries catch in the world ([www.lme.noaa.gov](http://www.lme.noaa.gov)).

The LME boundaries are defined taken into account ecological criteria, rather than political or economic ones, and it sustainability state is assessed by a set of indicators, related to productivity, pollution/health, fisheries, use of resources, etc. The assessment of the Brazilian Continental Shelf by the GIWA classifies the coastal/marine areas into three main domains - South, East and North Regions (respectively named LME 15, LME 16 and LME 17).

A brief characterization of the Brazilian LME concerning its main features, uses and threats are provided in the following tables, composed based on GIWA assessment report (UNEP, 2004), about the changing states of coastal and ecosystems along the Continental Shelf. Along with each table (tables 6, 7 and 8), there is a correspondent figure depicting the geographic scope of each LME.

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<sup>10</sup> Large Marine Ecosystems (LMEs) is an initiative of a group of organizations committed to monitor and assess the changing states of coastal and marine ecosystems on a global scale, helping countries to reconcile its needs and objectives with those at international scale. More information available on: <http://www.lme.noaa.gov>. Access on 15/02/2010.

Table 6 - Large Marine Ecosystem corresponding to the South Brazil Shelf (LME 15) in the scope of the Global International Waters Assessment (GIWA)

LME # 15 South Brazil Shelf	
<b>Characterization</b>	<ul style="list-style-type: none"> <li>- Extends from Rio Grande do Sul to Rio de Janeiro</li> <li>- Comprises 565,500km<sup>2</sup></li> <li>- Dominance of South Equatorial Current</li> <li>- Influence of Malvinas current and Plata River plume along the coast</li> <li>- Influence of big rivers, lagoon and estuarine systems</li> <li>- Wide continental shelf (220 km max.)</li> <li>- Seasonal upwelling (wind-driven) and cold water intrusions</li> <li>- Moderate to high productivity</li> <li>- South bays represent the main source of primary production</li> </ul>
<b>Fisheries</b>	<ul style="list-style-type: none"> <li>- Commercial fisheries (half of national production)</li> <li>- Artisanal fisheries participates with 22% of commercial captures</li> <li>- Oceanic and deep fisheries in continuous expansion, but with fluctuations in catch fields</li> <li>- Overexploitation, excessive <i>bycatch</i>*, and destructive fisheries are severe impacts related to the activity</li> </ul>
<b>Other uses and threats</b>	<ul style="list-style-type: none"> <li>- Urbanisation, petroleum exploitation, port operations, agriculture, fertilisers industries, tourism, fishing and agriculture are significant pressures</li> <li>- Heavy metals pollution</li> <li>- Megacities' impacts (Rio de Janeiro and São Paulo)</li> <li>- Occupation of catchments (urban waste load carried along the rivers to the sea)</li> <li>- High degree of eutrophication in bays and estuaries due to organic pollution (urban sewage)</li> <li>- Dredging and deforestation have increased erosive process</li> </ul>

\* Unwanted marine creatures that are caught in the nets while fishing for another species, usually associated with trawling gear

Source: large Marine Ecosystems of the World. Available at: <http://www.lme.noaa.gov>

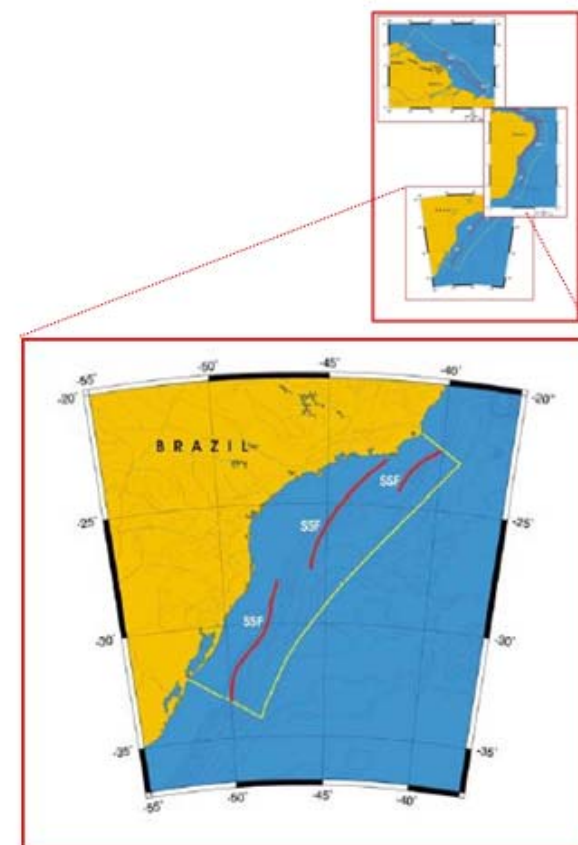
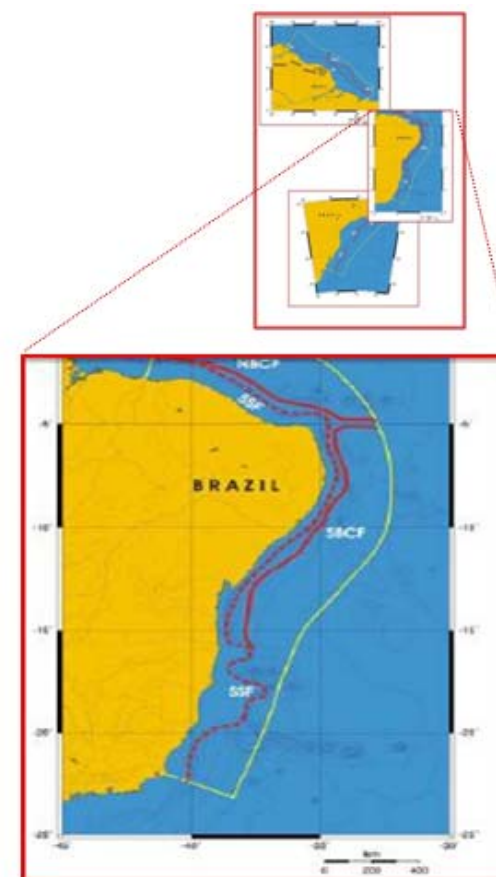




Table 7 - Large Marine Ecosystem corresponding to the East Brazil Shelf (LME 16) in the scope of the Global International Waters Assessment (GIWA)

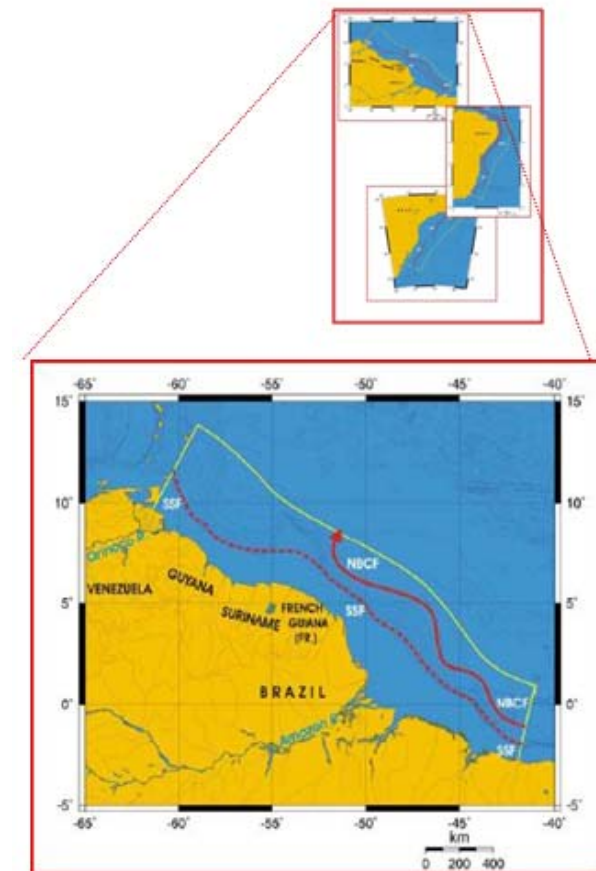
LME # 16 East Brazil Shelf	
<b>Characterization</b>	<ul style="list-style-type: none"> <li>- Extends from Rio de Janeiro (Cape São Tomé) to Parnaíba Estuary (Piauí state)</li> <li>- Comprises 1,1 million km<sup>2</sup></li> <li>- Dominance of South Equatorial Current dominates</li> <li>- Narrow continental shelf</li> <li>- 35 rivers drain to the sea</li> <li>- Presence of coral reefs and sea mounts</li> <li>- Coastal upwelling (South Atlantic Central Waters)</li> <li>- Generally poor nutrients waters (oligotrophic system)</li> </ul>
<b>Fisheries</b>	<ul style="list-style-type: none"> <li>- Artisanal fisheries (focused on lobster, shrimp and red snapper catch)</li> <li>- Commercial fish of Tuna in offshore areas</li> <li>- Over 70% of commercial fisheries stocks overexploited or collapsed</li> <li>- Sea bottom and ecosystems destruction by trawling (shrimp fishery),</li> <li>- Excessive <i>bycatch</i></li> </ul>
<b>Other uses and threats</b>	<ul style="list-style-type: none"> <li>- Densely populated areas</li> <li>- Moderate to severe habitat modification</li> <li>- Marine pollution linked to sea-based activities: unplanned coastal development and tourism centres (organic pollution- sewage), industrial activities and agriculture (chemical pollution), shrimp farms</li> <li>- Groundwater contamination (e.g. Bahia)</li> <li>- Offshore: oil exploitation (oil spills and permanent pollution by refuelling and washing of ship tanks)</li> </ul>



Source: large Marine Ecosystems of the World. Available at: <http://www.lme.noaa.gov>

Table 8 - Large Marine Ecosystem corresponding to the North Brazil Shelf (LME 17) in the scope of the Global International Waters Assessment (GIWA)

<b>LME # 17</b> <b>North Brazil Shelf</b>	
<b>Characterization</b>	<ul style="list-style-type: none"> <li>- From the Parnaíba estuary to the Caribbean Sea</li> <li>- Comprises 1,1 million km<sup>2</sup></li> <li>- Dominance of North Brazilian Current (extension of the South Equatorial Current and its prolongation, Guiana Current)</li> <li>- Strong influence of Amazon River discharge on shelf topography and as external source of materials</li> <li>- Wide continental shelf</li> <li>- Presence of coastal reefs fridge and sea mounts</li> <li>- Occurrence of macrotidal</li> <li>- Highly productive ecosystem (Amazon River as main source of nutrients)</li> </ul>
<b>Fisheries</b>	<ul style="list-style-type: none"> <li>- Multispecies and multigear fisheries target both by national and foreign fleet</li> <li>- Diversity of shrimps, characterising one of the most important shrimp fisheries in the world</li> <li>- Overexploitation, excessive <i>bycatch</i>, and destructive fisheries are severe impacts</li> <li>- Use of explosives and poisons on the reefs as mangroves as mean of capture (octopus and crabs, respectively)</li> </ul>
<b>Other uses and threats</b>	<ul style="list-style-type: none"> <li>- Moderate pollution, severe in some urbanised spots</li> <li>- "Hot spots" of population, coastal basins densely used, with vast unoccupied areas</li> <li>- Water contamination by sewage discharge, solid wastes, agrochemicals, industrial effluents</li> <li>- Mercury from agrochemicals is the main source of chemical pollution</li> <li>- Fertilisers and pesticides from sugarcane plantations</li> <li>- High potential of transboundary pollution (Guiana) due to the coastal hydrodynamics</li> <li>- Susceptibility to erosive process (mangrove destruction)</li> </ul>



Source: large Marine Ecosystems of the World. Available at: <http://www.lme.noaa.gov>



### 3.1.3. Socio-economy and vectors of environmental pressure

The socio-economic aspects of the coastal zone in Brazil are intrinsically related to its physical and natural conditions, which determined particular patterns of occupation based on exploration of different resources over the time (Egler & Rio, 2002).

The preference for the coastal region evidenced today has its origins in the colonization process which begun from sea, establishing, therefore, the first settlements in the coast (Moraes, 1999). The inland areas have also had leading role in agrarian, mineral and living stock activities in different historical periods, but once have prevailed an agro-exportation model, mainly based on wood, sugar cane, sugar, cocoa, gold, cotton, rubber and coffee, increasing support installation in the coast have been required over the time, in order to make the maritime commerce economically viable (Moraes, 1999; Figueiredo, 2002).

During the process of urban-industrial consolidation in the country, associated with the period of 1930 – 1950, the coasts also were the primary areas for installation of base-industry and energetic sector<sup>11</sup>, giving rise to the spatial concentration of industrial complex verified until the present (Moraes, 1999; Egler & Rio, 2002). During this period, the transference of the Federal capital in the 1960's from Rio de Janeiro, to Goiás state, located in the middle of the country has been understood as a political decision intending to drive the development path towards the land, still dominated by rural activities (op.cit).

According to Moraes (1999) the industrialisation process prompted an intense migratory process conducting to the coast large contingent of population for areas without substantial measures of territorial planning, which were not completely absorbed by the sectors, increasing the demand for infrastructure and urban services, never fulfilled. The author complements that the occupation and urbanisation of remaining areas in the coast was related to the expansion of “second home” phenomenon, characterised by increasing acquisition of summer houses (op.cit). Finally, such huge economic dynamism has resulted in land speculation and expropriation of traditional communities, which has triggered conflicting situations involving property rights throughout the coast (Egler & Rio, 2002).

The intensification of occupation in the coastal zone in Brazil is clearly derived from those three main vectors of development: urbanization, industrialization and tourism exploitation (Moraes, 1999; Figueiredo, 2002). The current scenario reflects such processes: 23.9% of the country's population lives in the coastal cities, totalising around 40.6 million people (Scherer *et al.*, 2009). More than half of this contingent is concentrated in five largest metropolitan agglomerations on the coast (Belém, Fortaleza, Recife, Salvador and Rio de Janeiro), responding for 13% of Brazilian population (Asmus & Kitzmann, 2004).

As a result, the average population density in the coastal region is five times higher than national average – 105 inhabitants per km<sup>2</sup>, against 20 inhabitants per km<sup>2</sup> in inland areas –although the

<sup>11</sup> In this period the most exponent base-industry has been created: The National Petroleum Council (1938) after the first discoveries of commercial oil field; National Siderurgic Industry (1941); Vale do Rio Doce Company (1943); Hydroelectric Company of San Francisco (1945); Petrobras Brazilian Oil (1953).

coastal profile is quite varying (Asmus & Kitzmann, 2004). In the North, the average population density is 6,1 inhabitants per km<sup>2</sup> (Amapá state), whilst reach its highest values in Rio de Janeiro state (Sotheast) with 656,5 inhabitants per km<sup>2</sup> and in Pernambuco state (Northeast) with 803,0 inhabitants per km<sup>2</sup> (Asmus & Kitzmann, 2004). In Pernambuco some metropolitan cities have reached critical levels, such as Recife with 6,506 inhabitants per km<sup>2</sup> and Olinda with 9.656 inhabitants per km<sup>2</sup> (MMA, 2008).

In economic terms, the coastal activities respond for about 70% of the National Gross Domestic Product - GDP (Asmus & Kitzmann, 2004). According to Scherer *et al.*, (2009) the sectors with significant predominance are represented by:

- Industrial activities, particularly chemical and petrochemical sectors;
- Hydrocarbons exploitation and production (oil and natural gas), sectors that have raised the GDP of coastal municipalities (since 85% of oil and 59% natural gas reserves are offshore);
- Harbour and ports operations, with 14 major ports controlling more than 14 million tons/year; maritime transportation accounts for 95% of the Brazilian international trading;
- Marine extractive fisheries, producing about 700,000 tonnes per year (MPA, 2008<sup>12</sup>).

Besides for its economic potential, these sectors have been regarded as the most demanding in terms of strategic and operational planning due its increasing involvement in sectorial and environmental conflicts (Asmus & Kitzmann, 2004; Scherer *et al.*, 2009).

Additionally, the aquaculture sector dedicated to pond and cage shrimp culturing, although recently introduced in the coastal economy - in the 1990'-, has showing the highest expansion rate among coastal sectors, already competing with the oil sector (MMA, 2008). For that reason both activities have posed the major challenges for coastal management nowadays.

Currently, the major Brazilian production of oil and natural gas occurs offshore. Between 2000 and 2005, oil and natural gas obtained from offshore wells corresponded respectively to 85% and 59%, mainly located in the state of Rio de Janeiro (MMA, 2008). Furthermore, in 2007 have been confirmed the major oil discovery in the Brazilian history<sup>13</sup>, adding around 19 billion of equivalent oil barrels (oil plus gas) to the actual country's reserves, estimated in 14 billions of barrels. All different oil fields are located off-shore and might reach about 7,000 meters depth, containing an oil with high quality features (low density, acidity and levels of sulphur) thus, higher market value. The announced increase in oil production will certainly be accompanied by increasing demand for land-based support installations, as well as pipelines network, intensification of heavy vehicle traffic associated with oil extraction and transport. Based on such scenario, the demand for strategic

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<sup>12</sup> Ministry of Fisheries and Aquiculture (MPA) "More Fisheries and Aquiculture - Sustainable Development Plan (2008- 2010)". Available at: [http://www.conepe.org.br/sistema/arquivos\\_pdf/maispesca.pdf](http://www.conepe.org.br/sistema/arquivos_pdf/maispesca.pdf)

<sup>13</sup> Information obtained from Petrobrás website, available at: <http://www2.petrobras.com.br/presal/uma-nova-fronteira/>

planning and operational management is also likely to increase, particularly with respect to risk management to avoid the expansion of sectorial conflicts and environmental impacts<sup>14</sup>.

With respect to the aquaculture sector, in Brazil, the most representative line is dedicated to shrimp cultivation, mainly located in the Northeast region, where three states (Rio Grande do Norte, Bahia and Ceará) have responded for almost 80% of the national production (MMA, 2008). Its expansion has been felt in terms of area, total production and productivity, due to high level of technology currently employed (Asmus & Kitzmann, 2004). In 2002, the activity has take over 10,000 hectares of shrimp farms, producing about 60,000 tons of industrialised shrimp, 70% directed to the international market (ANA, 2002<sup>15</sup>). The total area required for shrimp cultivation is estimated in about 25,000 hectares, commonly victimising important coastal wetlands and mangroves (Asmus & Kitzmann, 2004).

Besides the industrial sectors, distinction should be made about the relevance of artisanal and small-scale fisheries sector in Brazil, in terms of employment and food provision (Diegues, 2008). Small-scale fisheries sector represents a labour intensive activity, being responsible for about 800.000 direct jobs; indirectly, around two million people are dependent on this sector which responds for about 60% of total extractive production in Brazil (Vasconcellos *et al.*, 2005). Despite its importance, its contribution to the formal economy is still out of the official statistics mainly due to difficulty of monitoring due to the geographical dispersion of the landing (Vasconcellos *et al.*, 2005). Artisanal and small-scale fisheries have a key role in Brazil, still misunderstood and mismanaged due to lack of more realistic approaches of planning and management efforts in the sector.

However, a continuous decline in marine fisheries catch has been stressed over the years, and 70% of the world's commercial fish stocks are either fully exploited, overexploited or depleted (Kay & Alder, 1999; UNEP, 2004; Vasconcellos *et al.*, 2005). The underlined causes in the literature are related to excessive exploitation by commercial fish industry, use of destructive capture techniques causing excessive *bycatch* and habitats destruction (shrimp trawling, use of bombs and poison); devastation and pollution of coastal habitats.

Along with fisheries, crustaceous such as lobsters and crabs play an important role in the economies of north and northeast regions of the Brazilian coast. Both resources are captured by an artisanal sector, although the lobster catches have mainly responded for international trade demands. The crab captures are directed to local tourism and constitute a specific sector ("crab's economy") with substantial social and economic importance (Mota, 2005; Ribemboim, 2007).

Besides the economic role of extractive economies, there is a subsistence component inherent to the coastal habitats and resources. Several traditional (non-indigenous<sup>16</sup>) communities are spread

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<sup>14</sup> In a period of 9 years, between 1992 and 2001, occurred 32 oil spills of great magnitude into water bodies. The most critical events were held in 2000, when 1,3 millions liters of oil have spilled in the Guanabara Bay (Rio de Janeiro) and 4 million liters of oil into a river in Paraná State (Asmus & Kitzmann, 2004)

<sup>15</sup> National Waters Agency (ANA), Aquiculture statistics (2002). Available at: <http://www.ana.gov.br/pnrh/DOCUMENTOS/5Textos/6-5Aquicultura.pdf>

<sup>16</sup> Traditional communities are differentiated from indigenous communities since they that its origins in the commingling of Indians, Europeans and Africans (Diegues, 2008).

along the Brazilian coast, such as the *praieiros* in the Amazon region; the *jangadeiros*, in the north and northeast region, *caiçaras* in the southeast and part of the south region, whose survival is directly dependent on agriculture and fishery, with more or less maritime culture, but equally depending upon a good environmental quality (Asmus & Kitzmann, 2004; Diegues, 2008).

In fact, the dynamics of population and urbanisation growth experienced in the Brazilian coast have not been successfully accompanied by measures of territorial planning fact that has caused a rapid degradation in the basis of coastal resources (Scherer *et al.*, 2009). The same trend applies to the uses made over the marine component of the coastal zone, although environmental and ocean planning policies have been shaped in Brazil since the 80's, they are reported as still under process of effective implementation (Cincin-Sain & Knecht, 1998; Polette, 2008).

Lamardo *et.al.* (2000) emphasise that environmental degradation and conflict, although characterised by a historical component, have been a trend particular evident in developing countries, where social demands and political intentions have imposed the need of fast economic growth, pushing environmental issues to lower level of priorities.

Indeed, the pressure for development have had an important role on the diversification and acceleration of social, economic and environmental conflicts in Brazil, since it has introduced political motivations to a multiplicity of sectors, whose development usually hold new elements of pressure, risk and threats (Lamardo *et al.*, 2000; Scherer *et al.*, 2009). However is also true that the threats posed by socioeconomic pressures on coastal ecosystems and resources have make the need for legal control of such process much more evident, resulting in the first movements towards planning and management at national scale in the beginning of the 80's (Cincin-Sain & Knecht, 1998; Asmus & Kitzmann, 2004).

Destruction of mangroves, coastal erosion, tourism, urbanisation, shipyard development, non-point sources of pollution, offshore oil production, offshore fisheries were identified as major coastal and ocean demanding issues in Brazil (Cincin-Sain & Knecht, 1998; Polette, 2008; Scherer *et al.*, 2009). Such impacts have led to severe social and environmental consequences, namely: loss of revenues and employment opportunities from extractive activities (fisheries, aquaculture); loss of aesthetic value and recreational areas, reducing tourism revenues and employment opportunities; reduced property value; water contamination (chemical and organic pollution), posing a risk for human health and ecosystems; increased cost of surveillance; increased cost of coastal areas maintenance, due to lower coastline stability and thus, higher vulnerability to erosion and flood events, and so forth (Lamardo *et al.*, 2000; Absher *et al.*, 2002; UNEP, 2004; Vasconcellos *et al.*, 2005, Scherer *et.al*, 2009).

There is also a series of inescapable conflicts of interest among sectors operating on coastal zone as competing for its resources, such as Jablonski & Filet (2008) have reported. In Brazil has been felt an intensification of conflicts opposing small-scale *vs.* industrial fisheries; shrimp farming *vs.* mangrove crab harvesting; tourism infrastructure expansion *vs.* local communities; oil and gas activities *vs.* fisheries and conservation objectives; protected areas *vs.* local communities. To those can be summed up conflicts among governmental agencies due to divergent legal mandates and missions, levels of power (federal, provincial, municipal).

In fact, multiple-use conflicts and environmental degradation have been regarded as the focus of coastal management problems, triggering many if not almost all planning initiatives worldwide (Cincin-Sain & Knecht, 1998; Kay & Alder, 1999). In the case of Brazil, these factors are also the major causes calling for governmental coastal management initiatives. High level of antropic occupation of coastal areas has resulting in growing of demands for land and marine resources, invariably leading to conflicts of use, access, and also to environmental impacts and related consequences. Face to such background, seems evident that no unique model or approach of planning and management will fit to the variety of situations found along the national coast. More detailed understanding of the situation is needed, as well as a proper governmental organisation in order to deliver planning and management initiatives throughout the country. Therefore, the institutional and legal framework related to ocean and coastal management in Brazil is described in turn, aiming to underline the available structure to cope with increasing conflicts in coastal and marine areas.

### **3.2. Institutional and legal framework related to ocean and coastal management in Brazil**

In Brazil, the administrative arrangements for coastal management and planning have held a permanent link between coastal and marine environments, grounding simultaneously landward and seaward management issues. A brief history of institutional developments on ocean and coastal management is following described, aiming to evidence the common origin of the planning and management efforts of the coastal and marine environments and its main developments up to the present date, concerning further aspects related to its objectives and principles, management issues, instruments/techniques of planning and management, aiming to give enough basis to reveal how the government is organised to deliver the planning and management initiatives in the country, and what has been achieved by such institutional arrangement. The main idea is to make an introduction to a topic latter discussed: how the coastal and marine streams have made use of the techniques and instruments of planning and management currently available, reported and discussed worldwide, and how the multiplicity of sectorial interests have been incorporated into such experiences.

#### **3.2.1. Evolution of Brazilian policies in the ambit of ocean and coastal management**

The international negotiations related to the institution of a common policy for ocean governance and the proposal to establish an Exclusive Economic Zone for coastal nations (UNCLOS II) has been interpreted as trigger force that have incited countries worldwide to organise an administrative structure to be in charge of issues involving the management of ocean resources, recognising its strategic value (FAO, 1987; Churchill & Lowe, 1988; Cincin-Sain & Knecht, 1998). Such reflex could also be seen in Brazil through the creation of an *Interministerial Commission for Sea*

*Resources* (CIRM<sup>17</sup> – Comissão Interministerial para os Recursos do Mar) in 1974, a federal body headed by the Navy Ministry, including representative members of several Ministries (Asmus & Kitzmann, 2004).

The stated objectives of CIRM were the development of a national ocean resources policy intending to promote research and development of maritime-based sectors, through research and rational management of its resources. Furthermore, the legal frame was expected to improve coordination and to solve inter-governmental and inter-ministerial conflicts with regards to the use of coastal and marine resources (Cicin-Sain & Knecht, 1998). In fact, the creation of the CIRM is the starting point of the ocean and coastal policy in Brazil, and it has been regarded as the most remarkable characteristic of national initiative on ocean and coastal management, being able to promote horizontal integration among sectorial departments of the governments, such as fisheries, port, environment, and so forth (Cicin-Sain & Knecht, 1998).

Despite the conflicting issues involving the ocean were much more related to political disputes, the environmental concern in Brazil also arisen in the 70's, when industrialisation began to pose a real threat to the population and the environment (Asmus & Kitzmann, 2004). The occurrence of technological accidents in industrial areas involved release of chemicals called attention to issues such as public safety, human and environmental health, evidencing the need to adopt management measures in order to control the major sources of pollution and risk<sup>18</sup>. Consequently, in 1973 the *National Secretariat for the Environment* (SEMA - Secretaria Especial do Meio Ambiente) was created, with the objective to establish specific regulations for environmental protection. In this case, the international influence came from the United Nations-sponsored Conference on the Environment, held in Stockholm in 1972 (UNCED), which represented the first international and comprehensive effort related to environmental concerns worldwide (Cicin-Sain & Knecht, 1998). According to the authors, the UNCED motivated the creation of several environmental departments, agencies and ministries in many countries, including, thus, the Brazil.

Although contemporaneous, both institutions, SEMA and CIRM, were compromised with the creation of new guidelines and policies for their respective field of action – the environment in its integrity, and the marine environment; however, firstly performing in a disarticulated way.

In 1980, the CIRM instituted the *National Policy for Sea Resources* (PNRM – Política Nacional para os Recursos do Mar), formalising its duty to legislate over maritime resources and spaces. The *National Policy for Sea Resources* was planned to be developed by means of plans and programmes, based on decentralisation of management responsibilities (Asmus & Kitzmann, 2004). The intention of the PNRM was to articulate the diversity of sectorial policies focused on the ocean and coastal environments, but understanding the inherent differences of objectives and rationalities prevailing in the management of the coastal or marine domains. For that reason, the strategy was to separate the “agenda” into three major projects (Cicin-Sain & Knecht, 1998):

<sup>17</sup> All acronyms are presented in Portuguese, maintaining the official nomenclature of governmental bodies.

<sup>18</sup> <http://www.cetesb.sp.gov.br/emergencia/riscos/estudo/historico.asp>

- i. *Sectoral Plan for Sea Resources* (PSRM- Plano Setorial para os Recursos do Mar);
- ii. Coastal Zone Management through the implementation of the *National Plan of Coastal Management* (PNGC – Plano Nacional de Gerenciamento Costeiro) and *Survey Plan of the Brazilian Continental Shelf* (LEPLAC<sup>19</sup> - Plano de Levantamento da Plataforma Continental Brasileira);
- iii. Antarctic Research.

The premise of this primary segmentation of the PNRM was an alternative to bring together various governmental sectors with similar interest, attempting to address the demands of multiples uses and conflicts of a given geographic area (Kay & Alder, 1998). In fact, the Sectoral Plans constituted the strategy to manage the PNRM in a flexible manner through the review/ monitoring of efforts and identification of new issues, then promoting the direction of action to be followed in forthcoming years by means of a federal decree. On the other hand, the PNGC was a strategy to formalise the management of coastal/littoral resources, internationally understood as areas of national planning and characterised by a multiplicity of cross-sectorial interests (Scherer *et al.*, 2009). The survey plan LEPLAC represented the first research efforts in the scope of PNRM, intending to consolidate a knowledge basis about the reserves of strategic resources at sea (Asmus & Kitzmann, 2004) whilst the engagement of Brazil in Antarctic research efforts is related to the inclusion of the country in the Antarctic Treat in 1975, which prompted the establishment of a research basis in the continent to guaranteeing the national sovereign in the region ([www.esantar.furg.br/tratado.htm](http://www.esantar.furg.br/tratado.htm)).

Whilst the CIRM kept itself as head coordinator of the Sectoral Plans and ocean research programmes, in 1982 it instituted a sub-commission to be exclusively in charge of Coastal Management, setting the beginning of discussion to compose a national plan. The sub-commission organised a cycle of meetings focused on coastal resources and management discussions (Asmus & Kitzmann, 2004):

- 1983 - *International Seminar on Coastal Management*
- 1984 - *II Brazilian Symposium on Ocean Resources*: The first proposal for national coastal zoning was made and an experimental implementation begins in some coastal states;
- 1985 - *II ENCOGERCO – National Meeting on Coastal Management*: The institutional model to be adopted by the *National Programme of Coastal Management* (GERCO – Programa Nacional de Gerenciamento Costeiro) was defined, reiterating the concept of decentralisation and claiming for broad participation of stakeholders at different levels (governments, industry, society, etc) .

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<sup>19</sup> The LEPLAC started in 1987 and was enforced in 1994. It was a strategic survey about the real extension of the Continental Shelf, in order to enable the Brazilian Government to submitting a claim for the extension of the ZEE over the 200 nautical miles, following the limits of the Continental Shelf. This possibility is foreseen by the UNCLOS II, and could be done in a period of 10 years after the ratification of the Convention.

In 1987 the CIRM formally launched the GERCO, designating the methodology of zoning as primary instrument of planning, also presenting the institutional model for its application (Asmus & Kitzmann, 2004). One year later the PNGC is legally instituted by the Law nº 7661/88, being integrant part of the *National Policy for Sea Resources* (of CIRM) but also component of the *National Environmental Policy* (PNMA – Política Nacional do Meio Ambiente), launched in 1981 by SEMA, due to the importance of the environmental pillar sustaining all initiatives (Scherer *et al.*, 2009).

The stated objective of the plan, according to the Law nº 7661/88 is “to guide a rational use of the coastal zone resources, seeking for improvements on population’s quality of life, and the protection of its natural, historical, ethnical and cultural patrimonies” (Article 2º); whilst the PNMA seeks for “preservation, improvement and recuperation of environmental quality, assuring the conditions for a socioeconomic development, national security interests and protection for human dignity”. The clear convergence of objectives originated a permanent connection between coastal and environmental management, also linking institutions and initiatives later carried out. The primary interaction among the streams of ocean and coastal management in Brazil of those with the broad environmental policy is depicted in the figure 8.

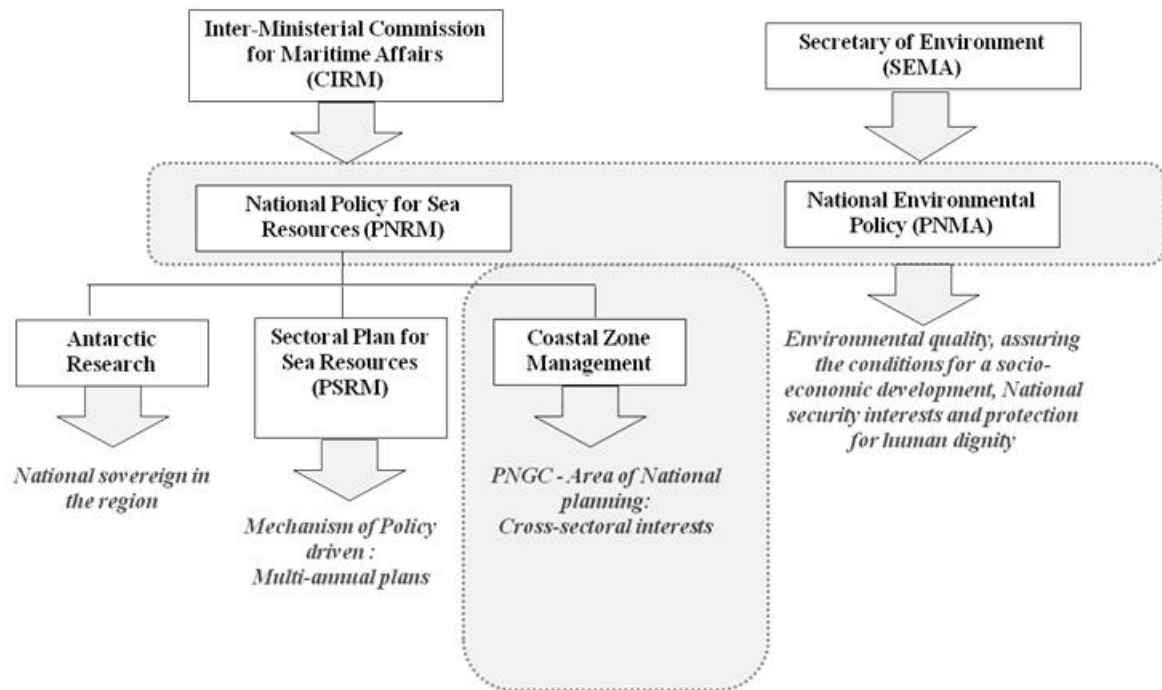


Figure 8 - Primary interaction between the environmental policy and the management of ocean and coast in Brazil.



With respect to the implementation and conduction of the coastal management, the provinces and municipalities were called to draw and carry out their own plans, in compliance with the national objectives established (Law n° 7661/88). Decentralised administration implied in granting autonomous power to sub-national levels of government (states and municipalities), such as the establishment of standards and guidelines for the use of soil, subsoil and water, as well as limitations on property rights (Article 5°), although always prevailing more restrictive propositions.

The instruments of planning were also given by the Law n° 7661/88, which emphasized two of them: i) zoning of uses and activities carried out on the coastal zone (Article 3°); and ii) establishment of protected areas (Article 9°). The free access of coastal areas was reaffirmed (especially to the beaches), and also the existence of penalisation in case of environmental damage (Articles 10° and 7°, respectively).

In the context of coastal management policy developments, is also important to mention the contribution given by the Federal Constitution of 1988, which declared “National Patrimony” the Coastal Zone, Amazon Forest, Pantanal Region, Atlantic Forest and Serra do Mar mountain ranges. Is important to highlight that Atlantic forest and Serra do Mar are ecological domains exclusively present in coastal region, thus, consolidating the support given by the Constitution to the coastal environment (Jablonski & Filet, 2008).

In 1992, the SEMA was transformed into *Ministry of the Environment* (MMA- Ministério do Meio Ambiente), which assumed the GERCO and began an evaluation of what have been done since that moment (Asmus & Kitzmann, 2004). Therefore, a new cycle of meetings was set. Firstly, in the National Meeting on Coastal Management (V ENCOGERCO), in 1992 a revision on the first PNGC was carried out, in order to incorporate some modifications made on the methodological approach. This document was later revised on a couple of meetings – VI ENCOGERCO, in 1994 and VII ENCOGERCO, in 1996 – being finalised in the last event.

Finally, in 1997 was launched the *Second National Plan of Coastal Management* - PNGC II, by the CIRM Resolution n° 05 of 1997. This plan consolidated a national strategy to the programme (GERCO), reformulated its objectives, activities coordination, defined its geographic boundaries and instituted the range of instruments for coastal and marine management (Asmus & Kitzmann, 2004). The PNGC II is the management plan currently operating in the Brazilian coast.

The central proposal of the GERCO had been established: to realign national public policies with direct influence on coastal zone, with the objective to integrate the activities of the provinces and municipalities and incorporate measures for a more sustainable and planned development (Scherer *et al.*, 2009). This mechanism of governance is defined as “networking” by Kay & Alder (1999: p.77), which keeps the existing government sectors, institutions and legislation, improving the communication among them.

In order to accomplish such objective, the CIRM creates, in 1997, a support group to coordinate, integrate and propose policies in the ambit of Coastal Management, the GI-GERCO (Group of Integration on Coastal Management), and a subgroup for integration of programmes at provincial and municipal levels. The designation of a coordinating commission or agency intend to inhibit power struggle problems among departments, since it usually has no legislative power and aim to

represent an integrated vision rather than a sectoral perspective (Cincin-Sain & Knecht, 1998; Kay & Alder, 1999).

The first product of GI-GERCO was the elaboration of the *Federal Action Plan for Coastal Zone* (PAF), launched in 1988, seeking for harmonisation of all governmental actions carried out on the coastal environment (Asmus & Kitzmann, 2004; Polette, 2008). Although the Federal Plan gave the fundamental basis for action in an integrated manner, the coastal management in Brazilian territory as well as its instruments of planning only came into reality after being legally enforced by a specific decree enacted in 2004 (Decree n° 5300/2004) regulating the Law n° 7661/88 and legally enacting the PNGC II as the primary coastal policy in Brazil.

Besides the norms related to the implementation of the PNGC II, the Decree n° 5.300/2004 also formalised the extension of the coastal management up to the limits of the Territorial Sea, established rules for use and occupation of the coastal zone (Chapter III), and set the limits, objectives, instruments and competences for the management of the “seafront” (Chapter IV). This last topic is particularly relevant since it introduced a sub-scale of management in the coastal environment, including a strip of land at the very edge of the sea and also part of the sea immediately adjacent to it, name seafront<sup>20</sup> (or “Orla” in Portuguese). The intention was to concentrate management efforts in a space characterised by high occurrence of conflicts related to the multiplicity of uses, competencies and regimes of property rights (public *vs.* private), with greatest demand for interventions to regulate the land use and occupation (MMA, 2005).

Seems evident the delay observed between the establishment of the PNGC (in 1988) and the legal institution of the coastal management instruments in Brazil (2004), in fact, the same situation could be observed with respect to the PNRM. Although the policy has been launched in 1980 by the CIRM, it only came into force in 2005, enacted by the Decree n° 5377/2005, despite the development of several sectorial plans since its establishment (see table 9).

In the case of the ocean policy, the regulation of the PNRM was dependent on the formalisation of the Brazilian jurisdiction on maritime space, defined after the ratification of UNCLOS by the federal government in 1988. The National jurisdiction on sea came into force some years later, in 1995, regulated by the Decree n° 1530/1995, ensuring the formal adoption of the UNCLOS II in the Brazilian maritime policy.

Notwithstanding, during this meantime of political adjustments, the PNRM has evolved by means of the Sectoral Plans foreseen as an action-driven mechanism. After the first Sectorial Plan, launched in 1982, a series of multi-annual plans were adopted, always centred on marine research, aiming to improving the national capability to exert its jurisdiction over the sea. The general intention was to compose the first panorama of Brazilian’s reserves of strategic resources, through the prospection and quantification of stocks offshore and in coastal waters, assisting the development of sectors involved (Miceli *et al.*, 2009). A chronological approach of the range of

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<sup>20</sup> This area responds for a variable component of maritime and terrestrial space, extending, seawards, for an area corresponding to no longer than 10m deep, and landward, 50m of extension in urbanised areas and 200m in non-urbanised areas (Decree 5.300/2004 - Art.23°). The limit on land also varies depending on the adjacent ecosystem (estuaries, cliffs, wetlands and erosive areas).

sectorial plans carried out since the 80's by CIRM is provided in the table 9, along with the main focus of action for that period.

Table 9 - Chronology of the Sectorial Plans for Sea Resources (PSRM) carried out in the scope of National Policy on Sea Resources

<b>Execution period</b>	<b>Sectorial Plan for Sea Resources (PSRM)</b>
	<i>Focus of Action</i>
<b>1982 – 1985</b> <b>(PSRM I)</b>	Better structuring of the research activities of marine resources, guiding significant interests of the Brazilian society to incorporate these resources into the national productive system
<b>1986 – 1989</b> <b>(PSRM II)</b>	Set goals that were intended to effectively contribute to overcome the socioeconomic difficulties of the country, through to improvement of technical and scientific organizations and human resources involved in their projects
<b>1990 – 1993</b> <b>(PSRM III)</b>	Considered the effects of ratification of the United Nations Convention on the Law of the Sea (UNCLOS) by the country, establishing the national goals concerning the research and exploitation of the resources of the Exclusive Economic Zone, launching a specific program to achieve this goal, called "Assessment Programme on the Potential of Sustainable Capture of Living Resources in the Exclusive Economic Zone" (REVIZEE)
<b>1994 – 1998</b> <b>(PSRM IV)</b>	Adaptation of PSRM III; the same goal was kept concerning the implementation of REVIZEE, followed by an new research project directed to enhancement of geological knowledge on the Brazilian continental margin, establishing, then, the "Assessment Programme on the Mineral Potential of Brazilian Continental Shelf" (REMLAC).
<b>1999 – 2003</b> <b>(PSRM V)</b>	Enhancement of the role of Marine Protected Areas in National waters: i) understanding of ecosystems and macro-processes in marine and coastal zones; ii) use of the marine protected areas for developing an Environment Monitoring Network and variable experiments; iii) utilization of the sustainable use categories recently instituted in the country for pilot-experiences in fishery management; 4) use of MPAs for dissemination of conservation concepts, sustainable use of natural resources, environmental education and awareness and a "maritime mentality".
<b>2004 – 2007</b> <b>(PSRM VI)</b>	Updating of the V PSRM; Finalisation of REVIZEE and implementation of a new programme to give continuity to the monitoring activities, the REVIMAR.
<b>2008 –2010</b> <b>(PSRM VII)</b>	Maintenance of the programmes focuses on the sustainable use of living and non-living resources, extending the actions for climatic and oceanographic monitoring, aiming to consolidate a national system monitoring areas beyond the limits of national jurisdiction.

*Source: Decree n° 5.382/2005 - VI Sectorial Plan for Sea Resources; Decree n° 6678/ 2008- VII Sectorial Plan for Sea Resource; Ministry of the Environment (2007)*

Concerning non-renewable resources, a significant example of investigation efforts at national scale was the Assessment Programme on the Mineral Potential of Brazilian Continental Shelf (REMPLOC), carried out since 1997, and still being improved. With respect to renewable resources, the REVIZEE/REVIMAR projects are outstanding initiatives, composing the first National inventory of living marine resources, aiming to accomplish with the commitments made in the scope of UNCLOS with respect to reordering of the fisheries sector and assessment of the sustainable potential of exploitation of renewable resources (Miceli *et al.*, 2009). The REVIZEE programme began in 1995, after the establishment of the national EEZ and has ended up in 2001, being followed by the REVIMAR, aiming to given continuity for the monitoring activities on fisheries stocks, in order to provide a long-term data base for management and decision-making on fishery sector. Such effort in research was done by means of an oceanographic cruise collecting samples in order to investigate the dynamics of the overall availability of living resources ([www.secirm.mar.mil.br](http://www.secirm.mar.mil.br)).

Within the sphere of the CIRM, the theme of protected areas (or conservation units) applied on marine and coastal environments were also addressed in the ambit of V Sectorial Plan for Marine Resources, running from 1999 to 2003. The plan set out a range of strategic actions, also focused on researches to be carried out in the scope of marine protected areas (Prates *et al.*, 2007), supporting and being supported by a set of policies launched by the Ministry of the Environment in that period (MMA, 2007).

Other ongoing projects and programmes carried out by CIRM<sup>21</sup> in the compass of the Sectorial Plans for Sea Resources:

- AQUIPESCA – Sustainable Aquaculture; Technological and Professional Qualification in the Fisheries; Development and Dissemination of New Technologies for Fishery and Fishes;
- GOOS/BRAZIL – Oceanographic and Meteorological Monitoring: Global System of Oceans Observation;
- PROARQUIPELAGO – Programme of the Archipelago São Pedro e São Paulo;
- ECOMAR – Study of the Structure and Functioning of Coastal and Oceanic Ecosystems;
- GT-PESQMAR - Consolidation of the Infrastructure for Ocean Surveys;

Furthermore, since 1984 is operating in the Island of King George, in Almirantado Bay, in Antarctica, the Brazilian Research Station Comandante Ferraz ([www.secirm.mar.mil.br](http://www.secirm.mar.mil.br)).

In effect, the legal federal root common to ocean and coastal management policies have being able to assure that the institutional arrangements have held a permanent link between coastal and marine environments, grounding simultaneously landward and seaward management issues. And despite both themes have been under governmental attention, they have assumed particular paths of evolution: the ocean management stream, triggered by political issues, were dedicated to compose the first panorama of Brazilian's reserves of strategic marine resources, through prospection and

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<sup>21</sup> Information available at CIRM webpage: [www.secirm.mar.mil.br](http://www.secirm.mar.mil.br)

quantification of stocks offshore and in coastal waters, assisting the development of sectors involved and the whole country. On the contrary, but in a complementary way, coastal efforts have mainly responded to conflicting management issues involving variables users, sectors, and specially, environmental degradation of coastal habitats and the basis of marine resources.

With respect to the sectorial and institutional integration, the creation of the CIRM itself and the GI-GERCO can be seen as an efficient option for sharing power and responsibilities among the variety of governmental bodies involved in ocean and marine affairs. Despite those particular bodies, coastal and marine policies have maintained the existing government sectors and institutions, seeking for improving the communication among them, whilst also sharing the environmental legislation as common ground and complementing with additional statutory basis.

And what has been achieved by such institutional arrangement? The general conclusion is that while the evolution observed in the field of coastal policy has culminated in the proposition of a more solid statutory basis, with defined scope, objectives, administrative structure and strategy of action; on the sea, the major improvements have been in terms of enhancement of national knowledge about strategic marine resources. Such scenario might represent an additional advance for future planning and management initiatives on marine environment, overcoming the lack of information that usually poses a limitation for planning and development projects, particularly common when dealing with complex systems such as the sea (Cincin-Sain & Knecht, 1998; Douvere, 2008).

### 3.2.2. Ongoing institutional arrangement on coastal management

On the whole, the coastal management is responsibility of the MMA, which aligns the GERCO at federal level with the activities of the States. The MMA also coordinates the range of inter-sectorial activities of Federal Government on coastal zone. The coastal management is integrated with the management of the sea resources, and the MMA must also articulate with the fishery sector (Asmus & Kitzmann, 2004).

The coordination of the federal actions is executed by the GI-GERCO, with support of CONAMA (National Council on Environment) consultive and deliberative body linked to the MMA, through the Technical Body of Coastal Management.

The 17 coastal states are expected to be the executors of the GERCO, along with the municipalities, whilst the IBAMA (The Brazilian Institute of Environment and Renewable Natural Resources) is responsible for the monitoring and control of the actions related to the coastal management. Moreover, it is in charge of the execution of the National Environmental Policy and responsible for environmental surveillance throughout Brazilian territory.

The CIRM is coordinated by the Navy Ministry, including representative members of eleven Ministries. Besides the elaboration of the guidelines for the PNGC and creation of the GI-GERCO, the CIRM also instituted another group responsible for a periodic revision of the GERCO, named CO-GERCO (nor yet operating). The CIRM is considered the facilitator of the coastal management

in Brazil, and has developed and sponsored several programmes, norms, costal and oceanic policies (Asmus & Kitzmann, 2004). The institutional structure of the GERCO currently operating at federal level is depicted in the figure 9.

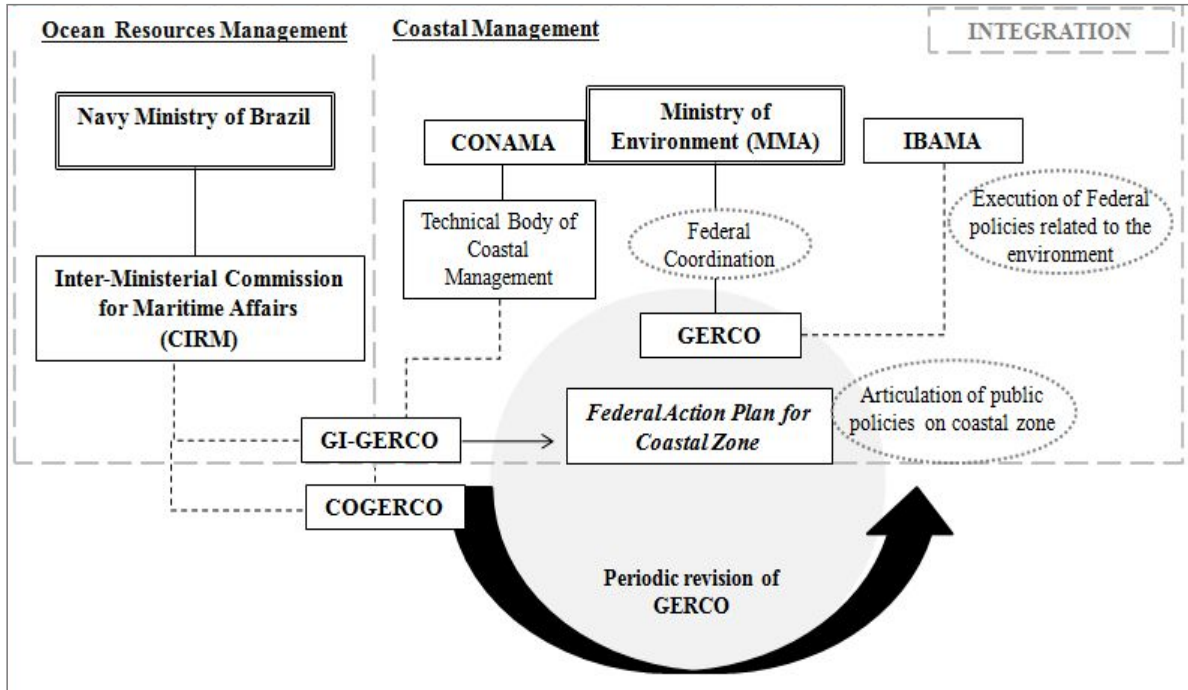


Figure 9 - Institutional structure of the National Programme on Coastal Management in Brazil (Federal level).

Cincin-Sain & Knecht (1998) have assessed the Brazilian Coastal Management policy and institutional structure, highlighting the position of the CIRM as sponsor and facilitator of the PNGC. Whilst many other coastal issues are addressed in a sectoral perspective, the CIRM has, since the beginning, foreseen an intergovernmental consistency that is very interesting for the success of the coastal policy. The separation of coastal and ocean issues also seems to be a satisfactory way to handle the particularities of each domain at least in the early stages of implementation of both policies (PNRM and PNGC) when institutional organisation and research are the primary focus. Forthcoming management measures must integrates both domains, making use of the growing promoted in each particular field to ground a common future path of development for those environments.

Despite the potential of such institutional arrangements to improve horizontal sectoral integration (CIRM) and vertical decentralisation (power to sub-national levels), seems clear the overload of which the IBAMA is submitted. The lack of infrastructure and inappropriate designation of IBAMA as the central agency for PNGC implementation, monitoring and surveillance is regarded as main limitation of national programme (Cincin-Sain & Knecht, 1998). And besides the range of functions related to the coastal policy, IBAMA has absorbing the same duties with respect to the

environmental policy (implementation, monitoring and surveillance) and also of fisheries development function (MMA, 2008).

### 3.2.3. Scope, principles, objectives and instruments of the National Plan on Coastal Management

It is a matter of fact that the management of the ocean and coasts in Brazil are formally articulated in its policy-basis, as has been recommended by International prescriptions in the ambit of Integrated Coastal Zone Management (Cincin-Sain & Knecht, 1998). Nevertheless, it is also true that specific strategy of action, assigned to an institutional arrangement and composed by a range of planning instruments was firstly contemplated by the coastal policy (GERCO), focusing particularly on that environment before goes further to the management of seaward issues, at the present moment in Brazil, less demanding.

However, it is also true the interests of the *National Policy for Sea Resources* in managing its strategic resources were responded by the PNGC in the scope of the Territorial Sea, since it is the seaward boundary of the coastal zone, given by the Decree nº 5300/2004. Kay & Alder (1998) explains that the adoption of a fixed distance for the ocean component of the coast usually considers the existent limits of governmental jurisdiction. Furthermore, such seaward delimitation is entirely applicable in Brazil since the Territorial Sea is considered as Union Property without any delimitation of State's jurisdiction areas, thus the pertinence of management guidelines coming from federal level (Jabloski & Filet, 2008).

All other marine management and planning activities beyond the Territorial Sea (which is included in the coastal zone) are competence of the Navy Ministry and the CIRM, since the Exclusive Economic Zone is also designed as Union Property, without sub-national jurisdiction (Decree nº 5382/ 2005). Nevertheless, this is a strategic area for some particular sectors, such as oil, natural gas, mineral exploitation as well as industrial fisheries, whose performance is basically concentrated offshore but completely dependent on land-based support facilities, therefore, calling for an integrated planning and management in the ambit of the coastal policy and related issues.

In the coastal zone, its boundaries have been set by the PNGC including those municipalities:

- i) Immediately in front of the sea;
- ii) Located in coastal metropolitan areas;
- iii) Conurbations of large cities and province's coastal capitals;
- iv) Situated within 50km of coastline, since it might cause impact on the coastal zone due to activities carried out there;
- v) Estuarine-lagoon municipalities; and finally
- vi) Municipalities whose boundaries are included in one of the cases mentioned above.

It means that the coastal policy is the responsible for defining the general rules and basis for plans and programs, at federal, provincial or local level in the geographical coverage correspondent to the national jurisdiction of coastal zone. For that reason, the PNGC II can be defined as a whole-of-

jurisdiction management plan, according to Kay & Alder (1999) classification, which conceives the elaboration of related regional and local plans (operational planning), based on the principles given at federal level (strategic planning). In fact, the coastal areas are where the demand for discipline uses, regimes of property rights, interests and sectors of activities often conflicting is higher (Cincin-Sain & Knecht, 1998; MMA, 2006). Furthermore, based on the legal delimitation of coastal area 395 municipalities were included in the Brazilian coastal management plan been called to develop their local initiatives.

In order to guide the actions of states and municipalities and shape the strategies at all levels, in ocean and marine environments, a set of common principles were established by the Decree nº 5300/2004 (Art. 5º), namely:

- Compliance with the *National Environmental Policy* and *National Policy for Sea Resources* and with international commitments made in the field of coastal and ocean governance;
- Integrated management of terrestrial and marine environments on coastal zone;
- The non-fragmentation of the natural unity of coastal ecosystems (in terrestrial strip), and the consideration of the municipal boundaries, given the requirements to perform the management process;
- Application of the precautionary principle as defined in Agenda 21;
- Preservation, conservation, control and rehabilitation of representative areas of the coastal ecosystem;
- Execution in accordance with decentralisation principles, assuring the commitment and cooperation between the spheres of government, and of those with society, in establishing policies and plans at federal, provincial and municipal level.

In sequence, based on the ongoing legal framework of coastal management in Brazil, the objectives of the GERCO, as well as its instruments of planning and projected actions are synthesised in the table 10.



Table 10 -Characteristics of the National Programme on Coastal Management, with refers to the objectives, instruments and projected actions.

Characteristics of the National Programme on Coastal Management	
<b>Legal enforcement</b>	- Federal Law nº 7661/1988 (PNGC I); Resolution CIRM Nº 05/1997 (PNGC II); Federal Decree nº 5300/ 2004.
<b>Objectives</b>	<ul style="list-style-type: none"> <li>- Regulation and planning of the use of natural resources and occupation of coastal areas</li> <li>- Establishment of an integrated, decentralized and participatory management of the socio-economic activities on the coastal zone</li> <li>- Systematic diagnostic of the environmental quality of the coastal zone, identifying its potentialities, vulnerabilities and predominant trends as essential elements for the management process</li> </ul>
Decree nº 5300/2004 Art.6º	<ul style="list-style-type: none"> <li>- Incorporation of the environmental dimension into sectorial policies oriented to the Coastal Zone</li> <li>- Control over agents of pollution or environmental degradation</li> <li>- Production and dissemination of knowledge necessary for the development and enhancement of GERCO actions</li> </ul>
<b>Instruments</b>	<ul style="list-style-type: none"> <li>- State Plan for Coastal Management – PEGC</li> <li>- Municipal Plan of Coastal Management – PMGC</li> <li>- Information System of Coastal Management - SIGERCO</li> <li>- System for Environmental Monitoring of Coastal Zone - SMA</li> <li>- Report on Environmental Quality of Coastal Zone - RQA</li> </ul>
Decree nº 5300/2004 Art.7º	<ul style="list-style-type: none"> <li>- Coastal Ecological Economic Zoning - ZEE</li> <li>- Plan of Coastal Zone Management –PGZC</li> </ul> <p>The Decree 5.300/2004 introduced:</p> <ul style="list-style-type: none"> <li>- Federal Action Plan for the Coastal Zone (PAF)</li> <li>- Macro-diagnostic of the Coastal Zone</li> <li>- Intervention Plan of the Seafront (Orla Poject)</li> </ul>
<b>Projected Actions</b>	<ul style="list-style-type: none"> <li>- Harmonization of GERCO actions with policies focused on coastal zone</li> <li>- Promotion of state and municipal plans, in a participatory manner</li> <li>- Carry out the Ecological Economic Zoning of states</li> <li>- Continuity and consolidation of SIGERCO</li> </ul>
CIRM Nº 05/1997	<ul style="list-style-type: none"> <li>- Compatibility and complementation of the legal norms ruling on the coastal zone</li> <li>- Implement actions that enhances the sustainable economic activities of traditional communities of the coastal zone</li> <li>- Plan the PNGC based on priority definitions and Annual Operative Plans (POA)* at federal, state and municipal level</li> <li>- To systematize the dissemination of the results obtained in the PNGC</li> </ul>

\* The elaboration of Annual Operative Plans is responsibility of the IBAMA, and shall be in line with the priorities set in the Federal Action Plan for the Coastal Zone.

Source: Adapted from Polette (1993).

As the table above has shown, the basis of the coastal management plan is statutory, making use of legislative instrument (legal framework) determining a strategic scope of planning and management at whole-of-jurisdiction of the coastal zone. Kay & Alder (1999) explain that a strategic plan provides the context in which more detailed plans and governmental policies are designed, and in that sense, its key function is to provide a long term vision to plan, indicating priorities and coordinating actions.

The legislative basis foresees the elaboration of state (PEGC) and municipal plans (PMGC and Orla Project) as well as a Federal Action Plan, and conceives a range of planning techniques to instrument forthcoming operational plans. Such division fits with the definition provided by Kay & Alder (1999), which understood operational planning as the most efficient level to assign, more precisely, the allocation of human and financial resources and infrastructure required to meet specific management objectives.

With respect to the planning and management techniques proposed in the scope of the coastal policies, all can be classified as administrative instruments of planning (Kay & Alder, 1999). However, distinction should be made between normative and technical-based instruments (Polette, 2008).

Polette (2008) differentiates the normative-focused instruments as those which establish the guidelines for elaboration and execution of the coastal management under federal, state and municipal responsibility. The Project of Integrated Management of the Seafront (Orla Project) deserves distinction from others since it has particular purposes and foresees a specific Intervention Plan. The normative instruments of coastal management and its objectives are described in turn, according to the definition provided by the PNGC II:

1. State Plan of Coastal Management – PEGC: legally established, it shall express the ramifications of PNGC, aiming the implementation of a State Policy for Coastal Management, including the definition of institutional responsibilities and procedures for its execution.
2. Municipal Plan of Coastal Management – PMGC: legally established, it shall express the ramifications of PNGC and PEGC, aiming the implementation of a Municipal Policy on Coastal Management, including the institutional responsibilities and procedures for its execution. The PMGC must keep close relationship with the land use and territorial occupation plans and other relevant municipal planning matters.
3. Plan of Coastal Zone Management –PGZC: includes the formulation of a set of strategic actions, articulated and focused, elaborated with the active society participation aiming to guide the implementation of Coastal Management. This plan can be implemented at different governmental levels and in variable scales of operation.
4. Federal Action Plan for Coastal Zone (PAF): has arisen from the need to reconcile the actions of PNGC with the governmental policies that affect the coastal zone, composing a document that would guide the many activities of the Federal Government on the Brazilian coast. The PAF must be structured into programmes and respective lines of action.
5. Project of Integrated Management of the Seafront (ORLA Project): The project aims to reconcile the environmental and patrimonial policies, transferring to the Municipalities the

responsibility of properties on the seafront areas under ownership or custody of the Union, currently concentrated in the Federal Government (in the Department of Union Properties – SPU). The project intends to introduce a systematic planning of the actions at local/municipal scale, adjusting the use and occupation of these areas to the environmental norms.

With respect to the technical-based instruments, particular attention has been given to the zoning, which is, in fact, a primary approach on territorial planning worldwide adopted (Clark, 1995), and already incorporated into Brazilian initiatives for land use planning at national scale (Del Prette & Matteo, 2006). It was specially enforced as instrument for coastal zone planning in the scope of the norms for use and occupation of the coastal zone sanctioned by the Decree nº 5300/2004, which set the Ecological Economic Zoning (ZEE) as mandatory for all coastal states. Due to its importance either as basic tool of land use planning or supportive instrument adopted in management of the marine space (e.g. zoning of marine protected areas), the methodological approach of ZEE will be further examined in a specific chapter.

The range of technical instruments suggested by the coastal management policy is described in the PNGC II as follows:

6. Coastal Ecological Economic Zoning: guides the territorial planning process, representing a support mechanism for monitoring activities, licensing, supervision and management; it aims to achieve a sustainable development of coastal zone, representing a regional application of a zoning process foreseen for all national territory.
7. Macro-diagnostic of the Coastal Zone: gathers information on national scale concerning the physical-natural and socio-economic characteristics of coastal zone, in order to guide conservation, preservation, regulation and supervision actions of the natural and cultural heritage.
8. Information System of Coastal Management – SIGERCO: component of the National System of Environmental Information - SINIMA, constitutes a system that integrates information of the PNGC, with those from database, geographic information system and remote sensing, providing support for subsystems structured/managed by States and Municipalities.
9. System for Environmental Monitoring of Coastal Zone - SMA-ZC: constitutes the operational structure to continuously collect data and information, in order to monitor the indicators of social and environmental quality of coastal zone, providing support for ongoing Management Plans.
10. Report on Environmental Quality of Coastal Zone - RQA-ZC: is the regular procedure for consolidation of the results produced by the environmental monitoring, allowing an evaluation of the efficiency and effectiveness of management measures and actions developed. This report will be prepared periodically by the National Coordination on Coastal Management, based on reports developed by the States Coordination.

In general terms, is possible to affirm that, in theory, national ocean and coastal management objectives and instruments are in compliance with those underlined by international prescriptions,

i.e. the coastal and seaward issues in Brazil are able to be handed accordingly, considering the current policy basis.

The existence of a whole-of-jurisdiction management plan which conceives the elaboration of related regional and local plans at operational level, based on the principles given at federal level, evidences a strategic planning approach. Despite the normative instruments, the technical approaches assumed by the coastal policy has inbuilt traditional concepts widely recommended by the international arena, such as environmental assessment and monitoring, along with innovative ones, recently highlighted in the international arena, such as spatial and digital processing tools.

The emphasis given to technical instruments based on GIS and digital processing systems is unarguably positive to the construction of the science and information basis in the country, being is a central element in an early stage of planning. In a forthcoming moment, such database will be able to provide reliable and accurate data to guide decision-making with respect to managerial issues in the ocean and coastal environments. In that sense, major concerns with the use and dissemination of such information is expected and desired.

In sequence, by evaluating the current practices on ocean and coastal management the present research aim to be able to drawn some conclusions about the performance of such spatial tools throughout the country, and if is readily applicable to seaward management issues.

### **3.3. Major approaches of planning and management on coastal and marine areas**

As the previous analysis of the coastal policy developments has shown, the coastal planning and management approach in Brazil is predominately grounded on administrative measures, making use of policy and legislation to determine and enforce a common set of techniques that must be used to manage both landward and seaward issues, readily adaptable to varying geographical focus or level of implementation. In this sense, seems true that the inherent interaction between ocean-coastal process and management demands have been handled in an integrated manner. However, is also true that there is yet no specific instrument that contemplates the particularities of planning at sea, such as the absence of physical boundaries, uncertainties about responses to pressures and impacts (Ehler & Douvère, 2009), the transboundary nature of numerous marine resources (Gubbay, 2004) or the tri-dimensionality of the marine space (Maes *et al.*, 2005).

Among all mentioned instruments of planning recommended in the ambit of the GERCO, is possible to affirm that zoning is more than a technique by itself. Besides its application as Ecological Economic Zoning tool, it has represented an approach and an intermediate procedure inbuilt in many of other instruments, such as the Macro-diagnostic of the Coastal Zone and the Orla Project, being also used in exclusive marine planning efforts (e.g. maps of marine sensibility for oil and gas exploitation, marine protected areas, etc). Moreover, zonation is the basic principle integrating the spatial approach assumed by all information and monitoring system proposed either for coastal or marine environments. Due to its significance, the zoning will be further analysed,

along with other support instruments increasingly consolidated as approach for conflict resolution in coastal and marine areas in Brazil - the protected areas and fisheries arrangements.

### 3.3.1. The primary instrument of planning: Ecological Economic Zoning

The zoning is the basic tool derived from a spatial planning approach, which become widely used as a central component of development and environmental planning in terrestrial areas (Kay & Alder, 1999; Douvere, 2008). More recently, it has come into common use also in planning natural reserves, providing spatial schemes to assist the management of protected areas at land and sea environments (Gubbay, 2004).

Since it is based on the concept of spatial separation and controlling of incompatible uses, the zoning is applicable to a variety of situations, being able to be adapted to suit local conditions and needs related to a particular social, economic and political conjuncture (Clark, 1995; Kay & Alder, 1999). The authors complement that zoning' broadly acceptance is not only related to such flexibility, but mainly to the simplicity provided to managers and planners. Moreover, it is a mechanism that integrates complex and often conflicting demands and land uses into a single map or plan, which usually is of easy comprehensiveness and interpretation.

For coastal management, Clark (1995) considers that there are two main purposes of the practice of zoning: i) *custodial* – useful to subdivide nature reserves into particular use allocation zones (e.g. visitation, diving, fishing, water sports); and ii) *regulatory* – applicable for regulatory programmes and coastal land use planning, to designate certain areas for particular uses (e.g. hotels, navigation, aquaculture, nature reserves).

In fact, the concept of zoning has continuously evolving - from a tool to support administrative matters concerning to the spatial regulation and control of the land use to a legal-political instrument of strategic territorial planning (Del Prette & Matteo, 2006). The emphasis given to the zoning lies in its potential to drives the socio-economic development, assisting the spatial distribution of development policies by guiding the strategic decisions of public and private investments with direct implications on the use of natural resources (Decree n° 4297/2002). In that sense, zoning has becoming a decisive element of environmental management, although the environmental protection is not only an aim by itself; natural resources are understood as “environmental assets”, whose protection is a conservative strategy to minimize environmental and social costs of public administration (Del Prette & Matteo, 2006).

In Brazil, the zoning has been the primary instrument of territorial planning introduced by national policies in different moments. Firstly, by the *National Environmental Policy*, in 1981, which conceived an “environmental zoning approach” designed to integrate natural aspects along with social and economic variables in the territorial management. Such perspective was developed to meet management requirements in the Amazon region, the first area to be zoned due to increasing levels of antropic pressures in the beginning of the 80's (Del Prette & Matteo, 2006). According to the authors, the strategy was triggered by increasing pressures also towards biodiversity protection:

by one side, coming from local environmental agencies, which have proliferated in the country after the UNCED in 1972; externally, the pressure came from international agencies concerned with the maintenance of this biome with global importance.

Later, the PNGC II conceptualised the term Ecological Economic Zoning (ZEE), extending the application of a spatial planning to coastal and marine areas, aiming to support management decisions. This later objective also has driven the adoption of the zoning as management tool in the scope of the new system of National Protected Areas (SNUC), through the Law nº 9985/2000 (Carvalho, 2007).

Finally, the ZEE had its basis legally established in 2002, when it was formally recognised as national instrument of planning integrating the *National Environmental Policy*, regulated by the Federal Decree nº 4297/2002. The law defines the zoning as “(...) *an instrument of territorial organization, which must necessarily be executed prior to the implementation of plans, constructions or activities, public or private, (...) aiming to ensure the environmental quality of water resources, soil and biodiversity conservation, seeking for a sustainable development and improvement of living conditions of the population*”. The law also defined the main criteria and guidelines for preparation and implementation of the ZEE in the national territory.

In 2001 a Coordination Commission of the Ecologic Economic Zoning was defined, along with a Permanent Group of Work on ZEE denominated Consortium ZEE-Brazil. Such Consortium has joint different Federal institutions under the MMA coordination and is the responsible for execution of ZEE at national level (MMA, 2008). Although its coordination and execution is concentrated at the Federal Government, the ZEE must respond to strategic interest also of states and municipalities (Del Prette & Matteo, 2006). In Brazil, the basic premise supported by Kay & Alder (1999) prevails: the scale of management and the objectives of each governmental level underpin the formulation of the zoning plan.

It is federal responsibility to set up the zoning when it directly involves a strategic organization of the territory within the national and regional level, which is defined as macro-zoning. The States have competence to promote the zoning on their level of administration, defined meso-zoning. The municipality must order the territory in their area of interest, particularly the urban areas, being called micro-zoning (Matos, 2003). The author explains that the existence of shared responsibilities for environmental zoning, and especially for the coastal zoning, does not imply that the state is the sum of municipal zoning, and that national zoning is the sum of the state zoning initiatives. Each sphere has specific objectives linked directly to their scale of work and dynamics that transcend the sum of the zoning of the political units that compose it. This fact is directly related to the multiplicity of methodologies of work, scales of analysis adopted and the expected outputs of the zoning.

In the case of the coastal zoning, the link among the scales of planning is given by the PNGC II, which has already set common objectives for all spheres of administration. But is important to bear in mind that the coastal and marine management in Brazil is integrant part of the National Environmental Policy (PNMA) and of the National Policy for Sea Resources, thus, it must incorporates all general principles fixed by such policies as well as international commitments established (MMA, 2008).

It is also fundamental to bear in mind that regardless the multiplicity of enforcement as instrument of planning, its implementation is still dependent on specific regulation, and here lies is the edge of its effectiveness (Polette, 2008). The ZEE is, by nature, a negotiable instrument of management, which after a sectorial agreement, must be legitimised by a specific law or decree. In that moment, the ZEE turns from a technical instrument into a juridical instrument. Nevertheless, this situation inevitably poses difficulties to achieve a compromised solution when dealing with sectors and institutions with different interests in the territory.

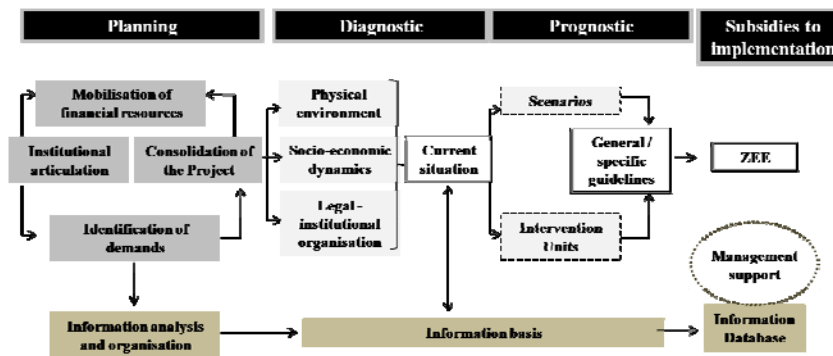
In effect, the Coordination Commission of the ZEE and the Permanent Group of Work on ZEE are expected to promote compliance of sub-national efforts with the national objectives, as well among those zoning initiatives with the broad territorial or marine policies, in case of the ocean zoning. If such role was assumed in an effective manner, the ZEE tends to give promising results at national scale, being thus, able to promote multi-sectorial planning, changing some (inefficient) patterns of land use, leading to a better management of socio, economic, cultural and natural resources.

### Methodological approach

The Environmental Ministry and the National Department of Zoning have recently established methodological guidelines for the Ecological Economic Zoning (MMA, 2007b). Basically, it intended to equalise and joint technical efforts (often unequal along the country) and scattered initiatives, improving the quality and compatibility of information at variable levels of planning. In that regard, the federal government expected to concretise the operational decentralisation foreseen in the coastal and marine management policy.

The basic idea behind the Ecological Economic Zoning procedure is the integration of landscape aspects, concerning its natural, social-economic and legal components (Polette, 1993). The range of variables included in each domain varies according to the characteristics of the area -particularly when focusing on coastal and/or marine zones – also considering the demands and objectives for planning. Basically, must be included land/sea uses, legislation and environmental features.

In general terms, the ZEE formulation comprises four main stages – planning, diagnostic, prognostic and implementation (MMA, 2007b) – associated with specific actions and partial diagnostics. The stages and main activities of the ZEE process, in line with the federal guidelines, is depicted in the figure 10.

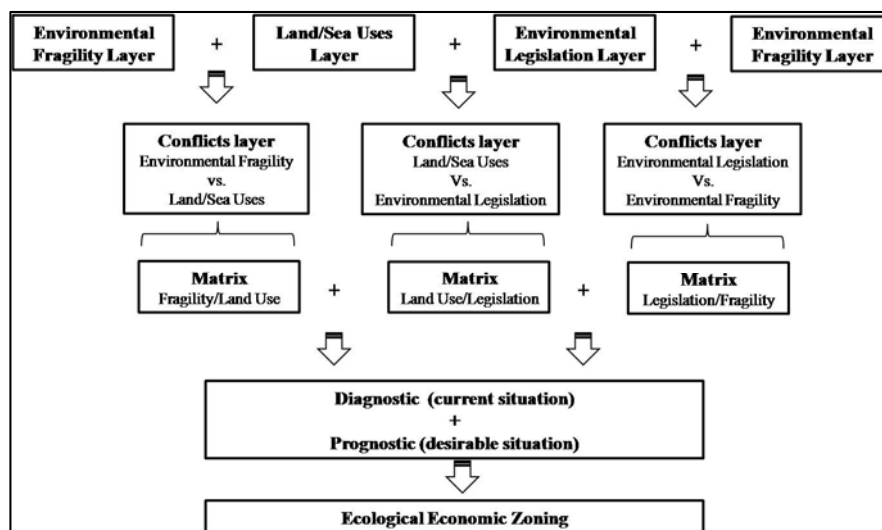


Source: Adapted from Ministry of the Environment - MMA (2007b).

Figure 10 – Main phases and activities involved in the Ecological Economic Zoning.

High weight must be given to the first stage of planning, since is in that early phase when the management demands are identified, as well as the institutional articulation and mobilisation of financial resources to compose the project. The available information must be gathered, in order to guide the next phase of diagnostic, in which the physical environment, socio-economic dynamics and the legal-institutional basis are analysed (MMA, 2007b).

The integration of the range of variables in the diagnostic phase results in a panorama of the current situation of uses (land or sea), and also aims to clarify the main limitations and potentialities of the planning in that area, given by the interaction among legal, physical and environmental information. It is achieved through elaboration of different matrix, indicating the areas of negative interaction of two or more characteristics (e.g. terrain slope and type of soil indicating erosion susceptibility, negative for urbanisation). The potentialities are shown by means of positive interactions. This process of integration is described in the figure 11.



Source: Adapted from Polette (1993).

Figure 11 - Integration of variables applied during the Ecological Economic Zoning.



Based on the diagnostic of current uses, a sequential prognostic phase focuses on the proposal of “scenarios of uses”, which are made based on the limitations and potentialities on the use of territory and/or its resources, identified by the matrix, aiming to clarify whose activities are suitable or not for development in the planned area (MMA, 2007b). Among the range of scenarios, a consensus about the “desired path” must be achieved, which does not constitute a merely technical choice, but it is, fundamentally, a political option. Based on the characteristics of each area, and the desired development scenario for the area, “zones of use” are defined, based on general criteria given by the Federal Government. In case of the coastal ZEE, for instance, the Federal Programme of Coastal Management has adopted a classification based on five types of zones (from 1 to 5), which represents two extremes:

*Class 1* - Areas characterized by presenting more pristine ecosystems, with presence of low impact human activities;

*Class 5* - Areas that have their original components seriously altered, with no possibility of spontaneous recovery.

For each class, there is a range of activities recommended or forbidden. For the purpose of integration of coastal zone management and ZEE undertaken at local level, for instance, the zones given by the PNGC has correspondence with classes that must be also adopted by the Orla Project.

The final aim of the ZEE is to compose a set of general and specific guidelines to support management decisions, whose spatial component is a zoning map. All range of information is also expected to be incorporated into a GIS, constituting a permanent instrument supporting monitoring and evaluation activities (MMA, 2007b).

It is important to notice that the ZEE is conceived to be a participatory and cross-sectorial process, which presupposes the involvement of public and private sectors and also, active participation of society (Del Prette & Matteo, 2006; MMA, 2007b). Usually, the participation is made by means of public discussion of the zoning scenarios, over which is discussed the technical and political conditions for its implementation. Based on the final scenario chosen must be drawn the legislation on ZEE (Del Prette & Matteo, 2006).

The related legislation foresees ten years for adjustments and alterations of the ZEE products, which includes changes in limits of the zones and indication of new guidelines, general or specific ones (Decree nº4.297/2002). After such deadline, all alterations can only be made after public approval (open audience) and favourable positioning of the national Coordination Commission of the ZEE.

Nevertheless, the concerned literature agree that coastal planning and management must invariably foresee more flexibility for continuous improvements, which will be mainly pointed out by monitoring and evaluation efforts; in that manner, the management-planning cycle is finally completed (Cincin-Sain & Knecht, 1998, Kay & Alder, 1999, Polette, 1993). Technical and conceptual adjustments are the most effective way to cope with the uncertainty about feed-backs and cumulative effects of activities on the environment, as well as its unpredictable long-term consequences. Furthermore, it allows that improvements on knowledge in different fields of

research (e.g. geography, oceanography, coastal dynamics, etc) could be properly incorporated into the planning purpose (Cicin-Sain & Knecht, 1998). For that reason, flexible mechanisms must be preferentially enforced as integrant part of the ZEE legislation, but giving particular attention to allow improvements but not unjustified manipulation of its primary results.

### 3.3.2. Support instruments of environmental management with implications on ocean planning

In addition to the regulations directly attached to coastal management legislation, additional instruments have supported environmental management actions, frequently with interesting applications on marine planning and management. Some have been legally grounded by the environmental policy and recommended by the coastal policy, such as the Marine Protected Areas (Diegues, 2008). Others have emerged as potential initiatives of managing multiples use of resources through legal or informal arrangements, such as those verified in the small-scale fisheries sector (Vasconcellos *et al.*, 2005; Kalikoski *et al.*, 2009). Planning and management techniques based on social aspects and capacity building, such as traditional practices, collaborative and community-based management have been increasingly adopted worldwide, being also referred as one of the biggest challenges to achieve an effective coastal management in many nations today (Kay & Alder, 1999; Cicin-Sain & Knecht, 1998).

In fact, mechanisms of planning and management in Brazil have evolved faster in fields disciplined by international conventions, in which general guidance for matters that involves shared responsibility are provided (Cicin-Sain & Knecht, 1998). Some of the conventions of which Brazil is signatory are particularly focused on maritime-related issues, and the range of compromises assumed worldwide towards a more sustainable management of the sea resources have helped to shape the national legal framework on the theme. According to the CIRM (2005) the most significant international treats with direct influence on the Brazilian jurisdiction over maritime space and resources are showed in the table 11.

Table 11 – International Conventions focused on maritime-related issues of which Brazil is signatory

Thematic Areas	Conventions
<b>Global Governance on the Ocean and Environment</b>	United Nations Convention on the Law of the Sea (UNCLOS);
	United Nations Framework Convention on Climate Change (UNFCCC)
<b>Biological Diversity</b>	Agenda 21, adopted in the United Nations Conference on Environment and Development (UNCED), also known as Rio 92
	United Nations Convention on Biological Diversity (CBD)
	The Convention on Wetlands of International Importance (Ramsar Convention)
	Inter-American Sea Turtle Convention
<b>Fisheries</b>	Code of Conduct for Responsible Fishing, of FAO (Food and Agriculture Organization of the United Nations)
	International Convention for the Conservation of Atlantic Tunas (ICCAT);
	International Convention for Regulation of Whaling
<b>Ocean Pollution</b>	International Convention for the Prevention of Pollution from Ships (MARPOL)
	Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)
	International Convention on Oil Pollution Preparedness, Response And Co-operation (OPRC 90)
	International Convention on Civil Liability for Oil Pollution Damage (CLC 69)
	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

Biodiversity conservation and fisheries management can be regarded as the fields with outstanding developments with respect to planning and management efforts, regardless the direct support of coastal management legislation (Wetzel & Poletti, 2002; Diegues, 2008). Their developments have reflected two main tendencies: on the governmental level, has been seen growing interest to accomplish political commitments made in the ambit of CBD's Programme of Work on Protected Areas (MMA, 2007), mainly through directing efforts towards biodiversity protection (see table x). In this sense, the establishment of a representative system of protected areas is part of a global strategy for biodiversity conservation, recently extended to the marine environment, where marine protected areas (MPA) are becoming the main management tool for conserving marine biodiversity but also for fisheries management (Gubbay, 2004; Prates, 2007).

On the other side, the initiatives involving fisheries management have also arisen principally of strengthening of local institutions, formal or informal, through support of abroad institutions such as NGOs, research centres and governmental agencies (Kalikoski *et al.*, 2009). In this case, the objective has been also to maintain the basis of marine resources but recognising its key role for the social and economic reproducibility of fishing communities and of the whole sector (Diegues, 2008).

Besides the introduction of support instruments of management, both “fields” have conceived variable scales of planning, and have been frequently triggered by resources depletion/degradation and resource-use conflicts (Carvalho, 2007; Kalikoski *et al.*, 2009). Very often, they have also incorporating a spatial component of planning (Freitas & Tagliani, 2009; Seixas & Kalikoski, 2009).

The linkage between the international prescriptions and national policies concerning the conservation of biodiversity and fisheries management is shown in the table 12, which also pointing out the main spatial planning components resulting from such initiatives.

In fact, biodiversity conservation and fisheries arrangements have evolved either independently or an integrated manner. The fishery sector – apart from conservation initiatives - has responding for several cases of informal arrangements to deal with conflicts involving fisheries resources and environmental quality, also addressing issues related to expansion of aquaculture, tourism and oil sectors (Cunha, 2001; Fabiano, 2004; Vasconcellos *et al.*, 2005; Diegues, 2008). In an integrated manner, Gubbay (2004) has called attention to the positive complementarity existent when merging both management tools – Marine Protected Areas and fisheries planning - stressing that the linkage has enhanced both conservation of marine biodiversity and management of the range of other activities and uses.

This situation has even more importance in Brazilian context, where the establishment of marine and coastal protected areas, in particular national parks, has been historically characterised by severe conflicts with local population, specially fishing communities (Diegues, 2008). In that sense, conflicts on the use of resources in the scope of protected areas can be better addressed.

Table 12 - Reflex of international commitments in national level policies

Themes	International Prescriptions	National efforts	Spatial Planning Components
<b>Biodiversity</b>	Agenda 21	Law nº 9.988/2000: National System of Protected Areas - SNUC	
	CBD	Decree nº 5.092/2004 and MMA Decree 2007: Priority areas for conservation	Mapping of Priority Areas for Biodiversity Conservation in Coastal and Marine Areas*
		Decree nº 5.758/2006: Strategic National Plan on Protected Areas (NPPA), as part of CBD's Programme of Work on Protected Areas	Implementation of Marine Protected Areas*
	Ramsar	Project Conservation and Sustainable Use of Biodiversity in Mangrove Protected Areas in Brazil	Mapping of mangrove areas*
<b>Fisheries</b>	Code of Conduct for Responsible Fisheries (FAO)	Participatory fisheries management in Protected Areas	Variable schemes of fisheries management
		Institutional arrangements and sectoral agreements focused on conflict resolution and co-management	Traditional knowledge and practices supporting fisheries planning and management

\*National scale projects, also composing a GIS database at federal level.

Since the initiatives developed in the ambit of MPA and fisheries arrangements are being increasingly recognised as useful support instruments for coastal management (Wetzel & Polette, 2002), some with direct implication on marine planning, their position in the national scene and legal context are further analysed.

### 3.3.2.1. National System of Protected Areas (SNUC) and its practical application in planning and management marine areas

The legislation pertinent to the coastal and maritime areas in Brazil is also supported by the National System of Protected Areas (SNUC – Sistema Nacional de Unidades de Conservação) which comprises different categories of conservation also applicable to the coastal and seascapes (Jablonski & Filet, 2008). The ongoing system (SNUC) was instituted in 2000 by the Law Nº 9.988/2000 and regulated by the Decree nº 4.340/2002, introducing distinct management categories and levels of protection, under national and sub-national jurisdiction (SNUC, 2000).

In the federal sphere, marine management initiatives have been legally supported by the Strategic National Plan on Protected Areas (PNAP - Plano Estratégico Nacional de Áreas Protegidas) which endorses the consolidation and implementation of the Programme of Work on Protected Areas of the Convention on Biological Diversity (CDB). The Brazilian programme was launched in 2006, and up to 2015 is expected to achieve a representative system of protected areas in the country, based on a set of principles, guidelines and strategies to the consolidation of the programme (MMA, 2007).

The major themes addressed by the PNAP are related to integration of wider land and sea environments under a ecosystem-based approach, taking into account ecological, social and cultural aspects; prevention of threats and mitigation of the negative impacts to the protected areas; promotion of a equitable sharing of both benefits and costs arising from protected areas; and finally, achievement of financial sustainability of protected areas and the SNUC (MMA, 2007).

In effect, the legal basis given by the international arena or by the SNUC does not modify, substantially, the instruments of planning applied in the scope of marine protected areas, which is also grounded on spatial zoning as primary approach; but in this case, the priority assigned for conservation objectives in detriment of others might act either as an additional reason for conflict among users or an inescapable argument supporting conflict resolution.

According to the priority areas for biodiversity conservation in Brazil, there are 3,344,658km<sup>2</sup> of marine areas of high level of ecological importance. For the coast, these areas totalise 958,766km<sup>2</sup> (MMA, 2007). Such representativeness in coastal and marine conservation is expected to be accomplished through the implementation of variable categories of protected areas. The National System of Protected Areas, since 2000, is composed by 12 different categories of management divided into two main groups: Full Protection (i.e. no-take areas) and Sustainable Use. The types of protected areas (called *Conservation Units* or UC – Unidades de Conservação) comprised by both groups and their respective objectives are showed in table 13.

Table 13 - Types of conservation Units (UC) in the ambit of National System of Protected Areas (SNUC).

Full Protection (Indirect Use)		Sustainable Use (Direct Use)
<i>Objectives</i>		
<i>Preservation of nature</i>		<i>Multiple use of natural resources</i>
<i>Admits only the indirect use of its natural resources (scientific research, visitation)</i>		<i>Conciliate nature conservation with productive use of part of its resources</i>
<i>Presence of an advisory council</i>		<i>Presence of a deliberative council</i>
Types of Conservation Units (UC)		
Ecological Station (ESEC)		Environmental Protection Area (APA);
Biological Reserve (REBIO)		Area of Ecological Interest (ARIE);
National Park (PARNA)		National Forests (FLONA);
Natural Monument (MN)		Extractive Reserve (RESEX);
Wildlife Refuge (RVS)		Fauna Reserve (RF),
		Sustainable Development Reserve (RDS)
		Private Reserve of Natural Heritage (PRNP).

*Source: National System of Protected Areas – SNUC (2000).*

As can be seen in the table, the categories of sustainable use constitute the prevailing type of protected areas in Brazil, and also correspond to the major area under such regime of management both at marine and terrestrial space (MMA, 2007). In fact, “sustainable use” indicates conciliation and management of multiples uses of natural resources in a manner that conservation objectives for that area can be primary fulfilled.

Some of the categories of sustainable use, such as Sustainable Development Reserve (RDS – Reserva de Desenvolvimento Sustentável) and Extractive Reserve (RESEX – Reserva Extrativista) are specially focus on improving the living conditions of local communities associated with the protected areas. The RESEX, in particular, has legitimised the necessity to incorporate socio-economic demands of traditional extractive communities along with protection of natural resources, by maintaining the range of resources-based economies in a sustainable and controlled manner (Cunha, 2001; Chammy, 2004). Among the achievements of RESEX’s experiences in Brazil, also implemented as Marine RESEX, the worthwhile results are related to the maintenance of extractive populations in their traditional areas, contributing to minimize territorial conflicts, expropriation and rural exodus (Cunha, 2001), as well as guaranteeing the reproduction of small scale fishing communities (Vasconcellos *et. al*, 2005), and also obtaining positive results in management and recuperation of fisheries stocks (Ferreira & Maida, 2007).

In recent years, RESEX has been the UC with major growing in Brazil (in number and area) and also of utmost importance for marine planning and management initiatives through the implementation of Marine Extractive Reserve (Diegues, 2008).

Independently of the category of UC, the planning and management instruments foreseen in the SNUC (2000) are basically three:

- I. The Council (advisory or deliberative, depending on the category of use);
- II. The Management Plan<sup>22</sup>;
- III. The Zoning.

According to the SNUC (2000), the Councils should try to be equally constituted by representatives of public institutions of different levels (municipal, state and federal) that might affect the UC (such as scientific research, education, national defence, tourism, indigenous people, etc) and also by civil society organizations (local NGO, resident population within or around the UC, private sector representatives, etc.). Its competences are related to monitoring the development, implementation and review of the Management Plan of the UC, identify and manifest sources of impact, assess the UC's annual budget among others. When deliberative, the council has an additional decision power besides its consultive character that is exclusively given to the Advisory Council (CNPT/IBAMA, 2004).

The Management Plan corresponds to the technical planning instrument, and must be based on the general objectives of the UC to propose the zoning (of the area and of the buffer zone), as well as the norms that will guide the use of resources and management initiatives (SNUC, 2000). In case of the UC of sustainable use, the management plan is necessarily of "multiple use" and must integrate a particular regime of governance instituting the collaborative management between the environmental governmental body and local communities (CNPT/ IBAMA, 2004). By the law, the management plans of any UC shall be consolidated up to five years from its creation, and the IBAMA has already launched specific roadmaps to support the preparation of management plans of different categories of UC. The major innovative component introduced by the SNUC (2000) in Brazil is that both direct and indirect use UC's are recommended to adopt continuous, flexible and participatory planning (CNPT/IBAMA, 2004; IBAMA, 2005).

The zoning is defined by the SNUC (2000) as *"(...) the definition of sectors or areas in a UC with specific management objectives and norms, for the purpose of providing the means and conditions for accomplishment of all UC objectives in a harmonious and efficient manner"* (Cap 1º, Art XVI).

In the Methodological Guidelines of Planning for Full Protection UC (Ecological Site, Biological Reserve and National Park) in its updated version launched in 2005 by the IBAMA, there is a set of steps that guide the execution of the zoning (IBAMA, 2005: p. 90). A gradational classification of zones is presented, according to the level of preservation of natural ecosystem or degree of human intervention, being classified as showed in the figure 12. For each zone are prohibited or allowed a specific range of activities and uses, and might occur differentiation of uses allowed/forbidden for particular categories of UC.

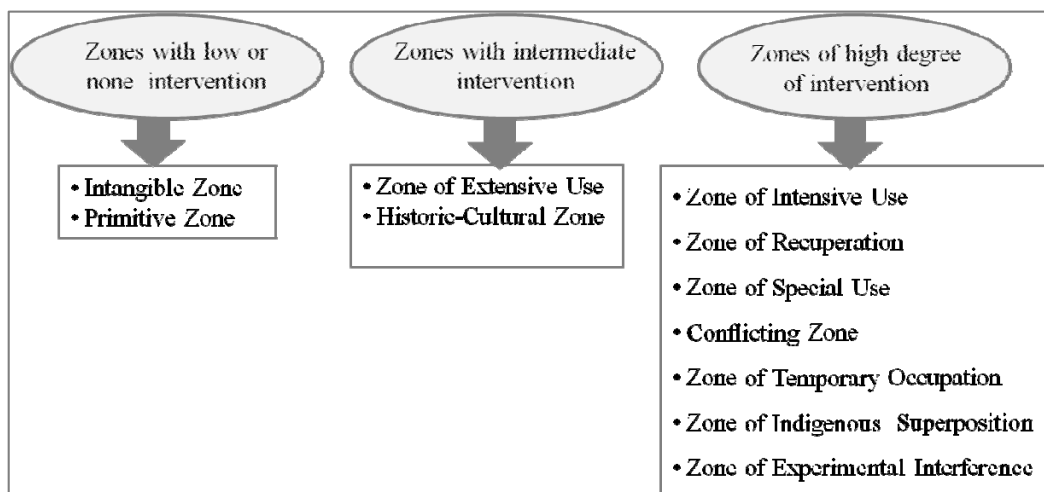
In sequence, criteria of zoning are given, some of which are physically (spatially) measurable, such as the degree of vegetations' conservation; variability in geomorphologic features; others are criteria indicatives of singularity, i.e. represent the level of particularities about a given UC that will certainly assist to the planning. These singularities criteria might be indicatives of values for

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<sup>22</sup> The Management Plan also involves a series of consecutive steps, such as broad diagnostics (social, biological and economic domains), study of carrying capacity (for indirect use UC) or sustainable potential of exploitation (for direct use UC), and many others intermediary procedures.



biodiversity conservation (e.g. environmental sensitivity; richness or diversity of species) or indicatives of vocational use (e.g. potential of visitation, conflicting use, presence of population, etc) (IBAMA, 2005).



*Source: Methodological Guidelines of Planning for Full Protection UC (IBAMA, 2005).*

Figure 12 - Classification of zones for Full Protection UC in Brazil, according to the degree of human intervention.

For definition of the buffer zone - the surroundings of an UC where human activities are subject to specific restrictions in order to minimize negative impacts on the protected area – the roadmap also indicates a set of criteria for inclusion of areas in the buffer zone, non-inclusion or adjustment of its boundaries (IBAMA, 2005: p.95).

With respect to UC of sustainable use, there is also a specific roadmap to support management and planning initiatives, in that case, mostly grounded on participatory and flexible principles, although varying according to the category of UC (CNPT/IBAMA, 2004). For planning and management of extractive reserves, current the most representative category in marine areas, the methodological guidelines includes tasks such as: identification and characterisation of traditional management; identification of access and use conflicts on the use of natural resources, rules of coexistence and mutual assistance, mechanisms of monitoring, etc. Particular emphasis is given to the adoption of participatory principles for its planning and long-term management, for which could be conceived variable spatial arrangements for resources management (CNPT/IBAMA, 2004: p. 47).

In the case of RESEX, the zoning of the reserve is more flexible and comprises variable areas where the zones do not defines the uses, instead of that, the current uses defines the management zones. According to the Methodological Guidelines of the Management Plan for Multiple Use Extractive Reserves (CNPT/IBAMA, 2004: p.63) the zoning must be able to identify the following uses' classes:

(i) housing and social facilities; (ii) additional agricultural and extractive occupation; (iii) area of collection and fishing (which might be divided according to species caught and/or categories of management), including boarding and landing points, huts and shelters for boats and gears, areas of perennial and/or seasonal traps, etc.; (iv) occurrence of endemic and/or endangered species; (v) areas of full protection (including cultural reasons); and (vi) exclusion of fishing and collecting areas, in time and space (existing and proposed).

Furthermore, both documents supporting full protection and sustainable use UC management foresee the implementation of a continuous monitoring process to assess the effectivity of the zoning and Management Plan adopted (CNPT/IBAMA, 2004; IBAMA, 2005). Concomitant development of scientific research and monitoring plans are also integrant part of the objectives stated in the protected areas policy (SNUC, 2000).

With respect to the planning at sea, both roadmaps analysed devote particular attention to some particularities of planning when dealing with marine areas. The main recommendations involves the inclusion of oceanographic variables in the characterisation of the area (e.g. bathymetry, bottom sediment, regime of winds, waves and currents), in the assessment of the coastal influence on the UC (e.g. discharge of sediments by rivers, estuarine plume, coastal currents); and in the delimitation of the buffer zone, also pointing out potential sources of conflicting activities at sea (e.g. washing of vessels' basement, discharge of ballast water, dredging, fisheries) (CNPT/IBAMA, 2004; IBAMA, 2005).

Nevertheless, despite the achievements so far, there are few mentions about the possibility of applying variable spatial arrangements to improve the compatibility of uses by making use of the tri-dimensionality of the sea (Fournier & Panizza, 2003; Carvalho, 2007), and only one case in Brazil assumed such idea (Carvalho, 2007). On the other side, time-based arrangements, such as temporary exclusion of activities for a specific purpose, reducing conflicting interests, is foreseen in both direct and indirect use UC's roadmaps (CNPT/IBAMA, 2004; IBAMA, 2005).

Giving the actual roadmaps for management of protected areas currently available, seems plausible to affirm that the planning and management activities developed in the ambit of Marine Protected Areas are primarily grounded, being subject to subsequently improvements by tailoring management solutions to the local reality, specially to the sea particularities.

### 3.3.2.2. Fisheries regulation and management: the purpose of participatory processes

Fishing and aquaculture on the marine portion of the coastal zone are also regulated by decrees and federal laws, in accordance with its classification as a Union property (Jabloski & Filet, 2008). The primary federal regulation is given by the Fisheries Code, set in 1967 (Law-Decree n° 221); however, the legal basis of fisheries sector is characterised by fragmentation. The multiplicity of federal regulations and normative instructions currently operating are excessively general or specific, usually intending to limit fishing effort by imposition of restrictions such as areas of

capture, minimum catch size, prohibition periods for capture of different species (for reproductive aims), among other (Vasconcellos *et.al*, 2005).

Some authors have emphasised that an brief analysis of the historical development of fisheries policies reveals divergent tendencies on the management of the resources, resulting in institutional conflicts of management derived from the contraposition of “development” vs. “conservation” visions of institutions in charge of it in different periods of times (Vasconcellos *et al.*, 2005; Jabloski & Filet, 2008).

The SUDEPE (Superintendência do Desenvolvimento da Pesca) was the institution of fisheries management in Brazil from 1970 to 1989, during which had prevailed a process of modernisation of the sector, national fleet and ports. The authors explain that after its extinction, there was felt an “*institutional empty place*”, and several conflicts have mainly opposed small-scale fisheries to industrial fisheries, oil exploitation, aquaculture, tourism and protected areas, usually resulting in expropriation of fisheries communities. At this period, the IBAMA assumed the duty on fisheries monitoring and management, and the conservationist vision prevailed. Since then the legal attempts have focused reduction of fisheries efforts and impacts of destructive fisheries gears (op.cit.).

In effect, small-scale fisheries sector, although its predominance along the country, has been historically misunderstood and mismanaged – situation often attributed to its technical, social and economic complexity (Vasconcellos *et al.*, 2005; Diegues, 2008).

Artisanal fisheries are multi-species, multi-purpose and multi-dimensional, making use of a variety of technologies, being carried out in a diversity of habitats and coastal micro-environments, and characterized by a division of labour across households, communities and task groups (Diegues, 2008). In light of such scenario, the centralisation of monitoring and management of small-scale fisheries under a single government agency has been regarded as impractical (Vasconcellos *et.al*, 2005).

On the other hand, the small-scale sector has felt continuous demand for a system of assessment and management that could give basis for decision making at the local level whilst also supporting national and international policies for the sector (Vasconcellos *et.al*, 2005). In effect, decentralization of fisheries management through the implementation and legitimation of co-management systems have been encouraged worldwide (Pomeroy & Berkes, 1997; FAO, 2002; Berkes, 2006). Shared fisheries management aims to improve effective participation of both government and users in the fisheries administration and represents a viable way to achieve the decentralization and to improve conflicts resolution, either between or within the fisheries sector.

Internationally, the institutional attention to the management of small-scale fisheries has been paid by the Food and Agriculture Organization of the United Nations (FAO), which recognise the necessity to understand the culture of small-scale fishing communities, in their forms of organization and production, in order to support policy making and governance of its practices (FAO, 2002). Currently, FAO has also pointed out the increase contribution of small-scale fisheries to poverty alleviation and food security worldwide (FAO, 2007).

In Brazil decentralised and participatory in fisheries management have been institutionalized through a variety of mechanisms, including Marine Extractive Reserves (RESEX), fisheries agreements and fisheries' forums (Vasconcellos *et al.*, 2005; Seixas & Kalikoski, 2009). Studies have also shown that the usual lack of public recognition does not mean absence of territoriality measures applied by artisanal fishermen, controlling the access of spaces and resources based on informal social agreements (Cunha, 2001; Diegues, 2008).

Despite the variety of collaborative arrangements, there is no general rule to achieve an agreement on use of resources - the scope of discussion/action are variable and have addressed demands at different scales and involving a multiplicity of interests. The only common premise is the engagement of resource' users in the whole management processes, regardless of the multiplicity denomination usually adopted (shared management, collaborative or co-management, community-based management, participatory management, local management) (Seixas & Kalikoski, 2009).

In effect, the same premise assumed for the "overworked" management terminology applies to the concepts of participatory management. Despite some particular differences regarded in the concerned literature (such as level of effective participation, degree power sharing, etc), the present study assumes the similar basis inbuilt in all terminologies - engagement of resource' users in the management processes - dismissing some other specificities.

The RESEX, which was already contextualised in its social importance and policy basis, has provided the legal framework for coastal communities to participate in the planning and running of protected areas through participatory management (Diegues, 2008). RESEX's participatory management principles are based on the establishment of clear and flexible rules for the co-management; conflict resolution discussed and agreed in a collective way; fair and equitable distribution of rights and duties (CNPT/IBAMA, 2004). The aim of achieving a sustainable management of natural resources in the long-term is put into practice through implementation of variable mechanism to promote optimisation of socio-productive organization, value addition to local production and identification and establishment of fairer forms of trade (CNPT/IBAMA, 2004). Special attention should specially be given to the renewal of living resources through assessment of its potential for a sustainable exploitation (op.cit).

Fisheries Agreements are arrangements that intend to define the rules of access and use of fisheries resources in a given region, drawn by the community and other users (Seixas & Kalikoski, 2009). It has its origins in agreements undertaken between fishermen in the Amazon region in order to regulate fishing activities in their rivers and lakes. Currently, it is a practice enacted by Normative Instruction (NI N°. 29/03) of IBAMA, set in 2003.

Fisheries' forums or co-management forums are space of debates to discuss conflicting interactions of artisanal and small-scale fisheries with other economic sectors, such as tourism or fishing industry (Seixas & Kalikoski, 2009). The resulting arrangements have no legal implications, but are usually recognised by both or more agents as a social agreement.

In fact, the involvement of fishermen and other users in the management of resources in Brazil is being broadly recommended independently of the institutional arrangement (Diegues, 2008; Seixas & Kalikoski, 2009; Kalikoski *et al.*, 2009). In effect, involvement of local users and broad

community are also integrant part of international prescriptions; furthermore, is reasonable to affirm that participatory fisheries management have representing the initiatives where the issue of “tailoring the demands of planning to the local context” have found more confidence to be effectively performed.

Therefore, since the general concepts of co-management and steps for achieving such aim are already given - sometimes also being legally enforced - forthcoming efforts should give priority for capacity building inside the communities, enhancing the potential and role of participation in the management process.

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#### **4. OUTCOMES OF COASTAL AND MARINE MANAGEMENT INITIATIVES IN BRAZIL**

After elucidate how the Brazilian government is organised to deliver ocean and coastal planning and management initiatives throughout the country, and how marine and coastal affairs have been addressed by the range of approaches, techniques and instruments of planning and management currently available, reported and discussed worldwide, the following objective is to identify and describe the most relevant experiences of planning and management on ocean and coastal areas in Brazil, intending to examine how these initiatives have incorporated the management of sea uses and to which array of interests they have responded.

Considering that besides the regulations attached to coastal management prescriptions in Brazil there have been identified additional instruments supporting costal and marine planning decisions, the analysis of outcomes of coastal and marine planning initiatives will be composed of two complementary perspectives:

1. In the scope of the coastal management policy, the analysis focuses the implementation of normative and technical-based instruments legally recommended;
2. In the scope of the National System of Protected Areas (SNUC), the analysis looks into the experiences developed in the theme of Marine Protected Areas and participatory fisheries management, including those initiatives formally supported by the SNUC (MPAs) and other institutional arrangements promoting collaborative practices of fisheries management.

The first part is designed to offer a broad overview on the level of implementation of the coastal management plans and instruments foreseen in the PNGC; afterwards particularly emphasis is given to planning efforts carried out at sea - developments of the Federal Action Plan and the Macro-diagnostic of the Coastal Zone.

The second part, focused on support instruments of planning at sea, introduces to the situation of Marine Protected Areas in Brazil, presenting as illustrative case the first zoning adopting the tri-dimensionality of the ocean as variable of management. The analysis moves towards the situation of participatory fisheries management in the country, describing some positive results achieved within MPA or not, such as institutional arrangements and informal approaches for improving planning and management efforts. In that regards, an illustrative case is also provided, describing the adoption of traditional knowledge to construct a spatial-based system of co-management.

In both perspectives of analysis, the preference has been given to experiences in which planning and management efforts included marine issues, and also for those which have tried to generate or make use of spatial planning components. The analysis of such experiences will look for its spatial results and products evidencing to which array of interests they have responded. Such description aims to leads to a final discussion about the compliance of Brazilian ocean and coastal management policies and actions with the international prescriptions on the theme, evidencing the major

obstacles still to overcome and futures perspectives for the country related to ocean and coastal planning and management. The diagram below synthesises the analysis of the outcomes of coastal and marine management in Brazil (figure 13).

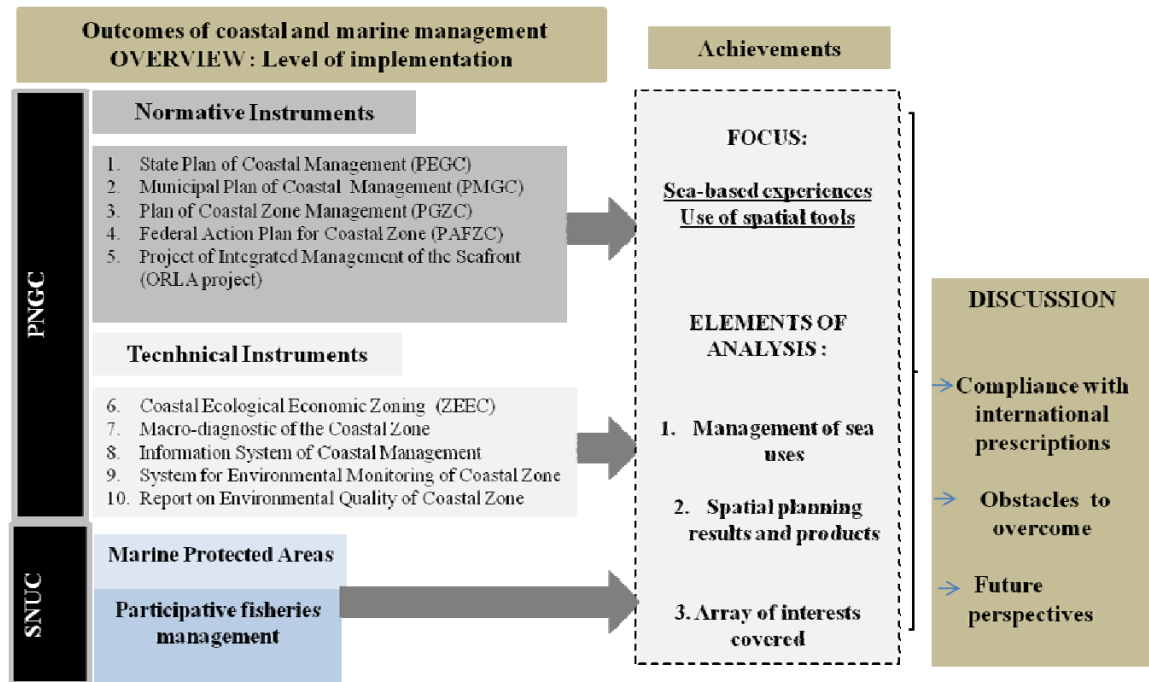


Figure 13 - Analysis of the results

#### 4.1. Current situation of the National Plan on Coastal Management and its instruments of planning

The implementation of the National Plan on Coastal Management and its instruments have advanced in recent years, despite the unequal development identified in different regions along the Brazilian coast (Asmus & Kitzmann, 2004).

Firstly, is worthy to point out that despite some figures about the adoption of the legal instruments of coastal management throughout the country, there is a complete absence of indicators of progress or evaluation of success of the coastal policy by the government, strongly limiting a real verification of the operational state of the PNGC in Brazil. The importance of evaluation mechanism of coastal programmes has been stressed as of fundamental importance for the progress of any integrated and cross-sectorial policy (Cincin Sain & Knecht, 1998), and it was indeed conceived by the PNGC, although has not been fully performed at the governmental sphere (Asmus & Kitzmann, 2004; Scherer *et al.*, 2009).

Among some evaluations identified in the national literature, the major part has been carried out in the ambit of universities and research centres/teams committed with the theme<sup>23</sup>. Related workshops and seminars have also provided interesting insights from civil society and have evolved faster in the last years with the support of non-governmental organisations, such as by the *Agência Costeira* ([www.agenciacoesteira.org.br](http://www.agenciacoesteira.org.br)).

It means that despite the reasonable availability of evaluations of the coastal policy, the data are still spread through different publications, and apart from the governmental sphere. To have an effect on the coastal policy, such assessment and derived propositions must be legitimised by the GI-GERCO and carried out by CO-GERCO, which is, by law, the institutional body in charge of periodic evaluation of the programme, but that still does not exist.

### 4.1.1. Application of instruments of planning and management

The MMA (2006) considers that there is a specific institutional context required to effectively ground the implementation of the coastal management, which can be evaluated through three main variables: i) the existence of a specific agency in charge with the coastal management; ii) the effort to consolidate a state plan of coastal management; and finally, iii) the establishment of a participatory instance, represented by local committees. For the MMA, these elements reflect the advances obtained in the decentralisation foreseen in the GERCO, which in turn, supports the national strategy of action.

Official data have shown that despite the long period of political discussion and improvements of its legal basis, there is still low level of compromise with the coastal management at the state level (MMA, 2006). Out of the 17 coastal states, only eight have created specific agencies responsible for coastal management, and nine states already have a Plan on Coastal Management. Only in five states the committees for participatory planning and management were formed.

At local scale, from 395 coastal municipalities only 56 have approved their management plans, although its spatial coverage in most cases does not comprises the whole municipal jurisdiction, being limited to small parts of the coastline where the demands for management is high (op.cit). Only about 10 municipalities have established management committees.

Scherer *et al.* (2009) has published official data of the MMA (not yet published by the governmental body) in which the implementation of some instruments of the coastal policy is more detailed described (table 14). According to such data, nine states have enforced the coastal management by means of law; however, Polette (2008) has identified in a recent survey other states have developing their coastal programmes despite the absence of legal enforcement up to date (e.g. PA, MA, PE, RJ).

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<sup>23</sup> Laboratory of Coastal Management (LabGerco) – Universidade Federal do Rio Grande – FURG/RS; Laboratory of Coastal Management – Universidade do Vale do Itajaí - CTTMar Univali/SC; Ibero-American Network of Coastal Management- Brazil.



The ZEE has been legally enforced in only five of the 17 coastal states, although its implementation has also been performed partially: four states have already concluded the ZEE, and eleven are developing partial zonings. Only two states, Alagoas and Espírito Santo, have not yet developed any zoning efforts. Nevertheless, besides its gradual adoption as instruments of territorial planning, is fundamental to analyse to which extend the zoning has been able to encourage substantial changes in land use. According to the MMA (2008) the zoning has been usually presented as the demarcation of existing land uses, being the “true picture” of what has happened in the present, therefore, not being useful for environmental management and losing its effectiveness in a short period of time.

Table 14 - Implementation of the instruments of the National programme on Coastal Management

COSTAL MANAGEMENT AND PLANNING INSTRUMENTS (GERCO)									
Coastal State		PEGC <sup>1</sup> (Law)	ZEE <sup>2</sup>			ZEE <sup>3</sup> (Law)	SIGERCO <sup>4</sup>	SMA <sup>5</sup>	RQA <sup>6</sup>
			Total	Partial	None				
North	Amapa (AP)	X	-	X	-	-	X	-	-
	Pará (PA)	-	-	X	-	-	-	-	-
Northeast	Maranhão (MA)	-	-	X	-	-	-	-	-
	Piauí (PI)	-	X	-	-	-	-	-	-
	Ceará (CE)	X	X	-	-	-	X	-	-
	Rio Grande do Norte (RN)	X	-	X	-	X	-	-	-
	Paraíba (PB)	X	X	-	-	-	-	-	-
	Pernambuco (PE)	-	-	X		X	X	-	-
	Alagoas (AL)	-	-	-	X	-	-	-	-
	Sergipe (SE)	-	-	X	-	-	-	-	-
	Bahia (BA)	-	-	X	-	-	-	-	-
Southeast	Espírito Santo (ES)	X	-	-	X	-	-	-	-
	Rio de Janeiro (RJ)	-	-	X	-	-	X	X	-
	São Paulo (SP)	X	-	X	-	X	-	X	X
South	Paraná (PR)	X	X	-	-	X	X	-	-
	Santa Catarina (SC)	X	-	X	-	X	X	-	-
	Rio Grande do Sul (RS)	X	-	X	-	-	X	-	-
	Total	9	4	11	2	5	7	2	1

1- Law or decree of the State Plan of the Coastal Management

2- Ecological Economic Zoning

3 – Law or decree of the Ecological Economic Zoning

4 - Information System of Coastal Management

5 - System of Environmental Monitoring of Coastal Zone

6 - Report on Environmental Quality of Coastal Zone

Source: Scherer et al. (2009)

Specifically for the marine portion of the coastal zone, only one state has carried out the ZEE is the Paraná, in the south region (<http://www.aen.pr.gov.br/>). The initiative has identified areas of pressure for expropriation of fisheries communities and conflicts among fisheries vs. ports activities; local small-scale fisheries vs. external large-scale fisheries; fisheries vs. environmental protection. Yet, no further materials are available, and there has been a speculation about the legitimacy of such zoning. The process has been regarded by the lower representativeness and involvement of the public at large, local sectors and research centres directly engaged in coastal and marine management in the region (pers. comm.).

With respect to the information System on Coastal Management (SIGERCO), the table above indicates that it is operating in seven states (Scherer *et al.* 2009). Asmus & Kitzmann (2004) affirms that eight other states have performed it independently and are in process of integration into the national platform. The System of Environmental Monitoring of Coastal Zone was adopted only by two states, Rio de Janeiro and São Paulo - the most demanding indeed - and the Report on Environmental Quality of Coastal Zone was implemented only in São Paulo. The lower level of implementation of such instruments is attributed both to the necessity of a national database to then subsidize monitoring efforts and to the lack of standardised and clearer procedures to develop the monitoring and reports (MMA, 2008).

### 4.1.2. Issues of execution and effectiveness

Polette (2008) recently conducted a participatory assessment of the coastal management programme in Brazil, involving stakeholders and agencies concretely related to the theme. The objective was to evidence the practical barriers (at political, economic, administrative, technical, legal and socio-cultural level) to the implementation of the national coastal policy. The survey included:

- Ten State Programs on Coastal Management at different regions (North: AP, PA; Northeast: PI, MA, PE; Southeast: ES, RJ, SP and South: PR, SC);
- 78 researchers in charge with management issues in 16 coastal states;
- 36 Non-Governmental-Organisations which work directly with coastal management in ten coastal states.

With the intention to improve the discussion, the issues raised in the survey were grouped into three main categories: i) Administrative and institutional issues, discussing decentralisation and political issues; ii) Participation of society; iii) Building the science information basis, with regards to technical and scientific support current available.

#### Administrative and institutional issues

With respect to the effectivity of the legislation the coastal management and its instruments of planning, Polette (2008) supports that it still has not been able to change the land use and

occupation pattern of the coastal areas. The majority barriers identified by the author are related to political issues, as are followed described:

- Lack of political will and strong political biasing, since often political party policies are inconsistent with existent environmental policies;
- Intra and inter-institutional disarticulation;
- Predominance of commissioned positions in long-term decision-making process;
- Lack of articulation between state and municipal policies for land use and occupation;
- Predominance of oligarchies in charge of public policies conduction at local level;
- Strong speculation of coastal land and properties in littoral areas;
- Local politician that avoid laws implementation in favour of sectoral interests;

Asmus & Kitzmann (2004) agree that political obstacles are the major barrier at all levels of administration for implementation of the coastal management. All state coordination of coastal management represented in the survey (Polette, 2008) accorded that the federal government has been incipient to respond to the main decision-making related to high-impact policies on the coastal zone (Polette, 2008: p.49). For Asmus & Kitzmann (2004), the challenge is also high at municipal level, where the politicians are usually led to the power by particular sectors which came to be later privileged, such as benefiting from properties commerce (p. 9). Directional consultancies were often mentioned as barrier for the effectiveness of licensing, permits and application of environmental and coastal policies. Bringing all together, one of the practical consequence is that public policies on coastal zone are not focused on long-time horizon.

There have also been felt difficulties concerning the decentralisation of planning, for multiples reasons. Primary, due to remarkable differences among coastal states with respect to: infrastructure and capability of the teams in charge of the coastal management; level of social organisation; dissonant socio-economic realities (level of social organisation, availability of basic services), among other (Asmus & Kitzmann, 2004). Discontinuity was also mentioned, due to distinct interests and political will within mandates, and also, between levels of government (Polette, 2008). As consequence, has prevailing the lack of institutional integration, vertical and horizontal, as well as distance between civil society and governmental/private power relations and decisions.

A fundamental issue was also identified by Polette (2008), the inexistence of economic instruments and/or models to give financial support to long-term planning and management actions (p.48). This situation can be attributed to the multiplicity of governmental bodies and cross-sectoral linkages required to cope with the coast - a geographical clipping that does not exist in the traditional structure of administration. Furthermore, the specific attributions and functions of each body involved in coastal management were regarded as not clearly defined.

### Participation of society

The lower level of participation and involvement of the society in decision-making is attributed to an insufficient divulgation, which difficult a better understanding of the process and the meaning of the costal management (Polette, 2008). In turn, it also interferes in the ability of the coastal plan to

meet the demands of society. With respect to the creation and consolidation of management committees, the obstacles are related to the difficulties to elect legitimate representations, as well as to sustain an operative committee when bureaucratic and slow administrative processes are faced (Asmus & Kitzmann, 2004).

The discussion of coastal management, however, has been increasingly motivated by the third sector, which have giving continuity to the ENCOGERCO, realised in 2002, 2004, 2006 and 2009. After 2006, a new strategy to promote the public discussion of the coastal management was adopted: the organisation of a new series of seminars at regional scale called *Sustainable Coastal Cities* ([www.agenciacoiteira.org.br](http://www.agenciacoiteira.org.br)).

The *Sustainable Coastal Cities* have already take place in the south region, giving rise to the first document expressing proposals of civil society for revision of the National Plan on Coastal Management (PNGC), despite the direct discouragement of GI-GERCO about such evaluation. Along with other issues, interesting emphasis was given to the application of Ecological Economic Zoning in marine areas, particularly questioning:

- A specific methodological approach to apply the ZEE in marine areas;
- Definition of how municipalities could participate in the marine ZEE;
- Integration of coastal and marine ZEE initiatives (much more effort have been put into coastal zoning).

The proposals of civil society for revision of the National Plan on Coastal Management (PNGC) have contemplated sound questioning involving practical barriers for coastal management, specially arising issues of marine management, evidencing a significant level of acknowledge about the process of management and its real demands.

However, many of other suggestions made – e.g. capacity building and formation of human resources involved in coastal management, specially at municipal level; definition of a strategic plan of action to communicate state and municipals instruments of management and planning - are already conceived by PNGC and GERCO. It might be an implication either of the lower level of dissemination of the coastal policy or is a clear symptom that such matters are still in need of become truly operative.

### Building the science information basis: technical and scientific support

Lack of technical support has also been continuously reported as barrier for integrated coastal management by the concerned literature (Asmus & Kitzmann, 2004; Polette, 2008). The authors point out a sub-utilisation of scientific and technical support of universities, which have not been part of coastal programmes and planning initiatives despite its increasing dedication to *management*, *oceanographic* and *coastal* lines of research, often integrant part of oceanographic and marine centres. Furthermore, capable professionals with experience on ocean and coastal process and dynamics are frequently absent of planning and management activities or official bodies at governmental level. One suggestive data of this situation is that the profession of

Oceanographer was officially recognised in Brazil only in 2008, after 31 years of professional mobilisation struggling for being accredited ([www.aoceano.org.br](http://www.aoceano.org.br)).

On the other hand, the evolution made in building systems for integration of management information seems to be major achievement of the coastal policy, and it is likely to revert such frame of lower scientific-technical involvement in coastal management decisions

At Federal level, despite the existence of a Centre of Remote Sensing (CSR) linked to IBAMA since its creation, only recently it have made use of spatial tools as executive instrument aligned to the Ministry of Environment and to the coastal policy ([www.siscom.ibama.gov.br](http://www.siscom.ibama.gov.br)). The CSR is responsible for production, systematisation, management and dissemination of environmental information, providing support to IBAMA and other governmental institutions. Since 2004 it has working along with the Centre of Environmental Monitoring (CEMAM) which has concretised the use of spatial data into environmental monitoring actions.

In 2006, there was included a specific working group on coastal zone linked to IBAMA, with the objective to define the methodology and rules for standardization of procedures for monitoring, processing, analysis and systematization of data for preparation of the Report on Environmental Quality of Coastal Zone (RQA-ZC), management instrument foreseen by the PNGC and evaluated as missing such procedures. Therefore, the practical goal is to consolidate an information system to gather, analyze and share data on socio-environmental information along the Brazilian coast. The database has been structured in the following thematic areas:

- Mapping of shrimp farming aquaculture in coastal regions;
- Mapping of mangrove ecosystems and associated ecological regions;
- Mapping of fishing rules;
- Mapping of ecological regions of the coastal zone;
- Priority areas for biodiversity conservation;
- Survey of cartographic/ organizational IBAMA data - coastal municipalities, Protected Areas and IBAMA centres.

The web platform currently available<sup>24</sup> also foresees the provision of environmental licensing guides for exploration and production of oil and gas (for seismic and drilling activities) and a national system of tracking of fishing vessels by satellite. The extent to which such projects are operating is not fully verifiable since most part of the information is still not made available or of restrict use. The majority of available information is related to other ongoing monitoring projects (e.g. Amazon Region and São Francisco River Basin), and in the ambit of priority areas for biodiversity conservation. Some variable GIS shapes files (raster/vector data and satellite images) are also made available.

However, the Brazilian potential to gather and share information through GIS platform tends to exponentially increase. The MMA has adopted the GeoNetwork Opensource, a standard based and decentralized spatial information management system with “friendly” interface developed by The Food and Agriculture Organization of the United Nations (FAO), The United Nations World Food

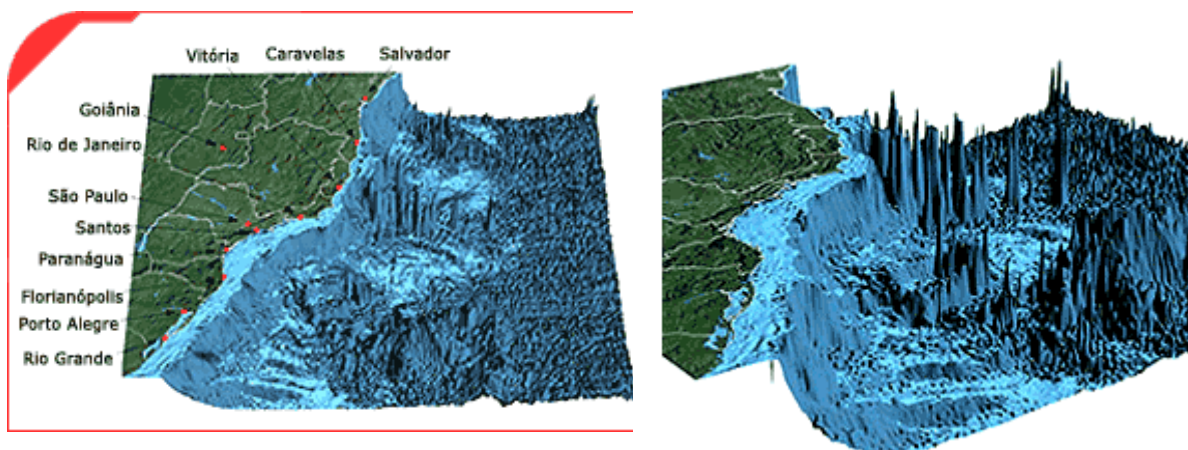
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<sup>24</sup> [www.siscom.ibama.gov.br](http://www.siscom.ibama.gov.br)

Programme (WFP) and The United Nations Environment Programme (UNEP). The GeoNetwork has been worldwide adopted and was designed to increase collaboration within and between organizations, reducing duplication and enhancing information consistency and quality. Furthermore, it improves the accessibility of a wide variety of geographic information along with the associated information, organized and documented in a standard way (CASCADOSS, 2007)<sup>25</sup>. Portugal, for instance, has already made use of GeoNetwork Opensource with the same purpose.

Currently, the web basis has already been implemented to deliver a multiplicity of information generated in the ambit of federal programmes, such as the mapping of priority areas for conservation of biodiversity protected areas; national biomes; Legal Amazon; physic environment and biodiversity, among others and is designed to aggregate the information of the Macro-diagnostic of the Coastal Zone in a near future (<http://mapas.mma.gov.br/i3geo/>).

Furthermore, the seabed of Brazilian continental Shelf and Exclusive Economic Zone has been recently mapped in its tri-dimensionality by researchers of the Federal University of Rio Grande FURG (figure 14). The initiative, unprecedented in the country, began in the ambit of the REVIZEE Programme and currently is expected to compose a geo-referenced information system on the Brazilian coast, which will serve as a basis for planning and management of marine resources of the country, among many other practical applications ([www.oceanografia-ufsc.blogspot.com.br](http://www.oceanografia-ufsc.blogspot.com.br)).



*Source: UFSC (2002) Available at: [www.oceanografia-ufsc.blogspot.com.br/Mapa%20marinho.doc](http://www.oceanografia-ufsc.blogspot.com.br/Mapa%20marinho.doc)*

Figure 14 - Tri-dimensional aspect of the Brazilian Continental Shelf seabed

<sup>25</sup> CASCADOSS is a project focused on development of a trans-national cascade training programme on Open Source GIS&RS Software for environmental applications, worldwide implemented, as part of new methods of promoting and encouraging transnational technology transfer. More information available at: <http://mapas.mma.gov.br/geonetwork/srv/en/main.home>

In general, the construction of science and information basis about the coastal and marine environment have proved to be one of the most developed fields of the coastal policy in Brazil. Furthermore, such goal has been visibly improved by the employment of spatial tools and digital processing, only recently adopted, but with high applicability for marine environment. Therefore, is sound to affirm that the main ground for forthcoming planning and management measures are being built, leading the next discussion to the practical cases identified, aiming to evidence the performance of such spatial tools throughout the country and check its effectivity with respect to seaward management issues.

### 4.2. Coastal and Marine planning initiatives at Federal level

At federal level, all the range of planning and management initiatives identified in marine areas was integrant part of the coastal policy efforts, always associated with the management of coastal issues. At this level, the initiatives have mainly assumed a strategic scope of planning, being primary based on spatial approaches that allowed the identification of critical areas, development patterns or areas with specific management priorities. According to Douvere & Ehler (2009), those have been exactly the main guidelines for the primary delineation of an integrated land and water use policies in the ambit of Agenda 21. The approaches chosen by Brazilian government and its main results are in turn described, aiming to evidence how the marine issues have been addressed by the coastal policy, which type of spatial approaches have been used and how the government has positioned itself to deal with the range of emergent interest.

#### 4.2.1. Federal Action Plan for the Coastal Zone (PAF)

The Federal Action Plan for the Coastal Zone (PAF) is organized by programs with respective lines of action designed in a convergent and complementary way, in order to improve the alignment of public policies of the coastal zone (CIRM, 1998). With the objective to set priority lines of actions for such programmes, a comprehensive characterization of the environmental assets available in the coastal zone was exclusively commissioned by the coordination of the GERCO, indicating the most demanding areas, resources and/or activities to be addressed in the ambit of the PAF (Diegues & Rosman, 1997)<sup>26</sup>. In light of such background, the PAF was divided into four programmes:

1. Programme of Occupation and Land Use Planning: Aimed to discipline the occupation and land use of the coastal zone at federal level, and also, to support and promote actions of other levels of government in this theme, especially local authorities.
2. Programme for Conservation of the Natural, Historic and Cultural Heritage: It contemplates the role of protection and restoration of coastal ecosystems coastal, drawing a federal policy for the management of the "national heritage" represented by the coastal

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<sup>26</sup> Diegues & Rosman (1997) - Characterization of Environmental Assets in Selected Areas of the Brazilian Coastal Zone. Study commissioned by the Coordination of the Coastal Management in Brazil.

zone. The lines of action cover both generic initiatives and a set of actions for a particular resource management.

3. Programme of Environmental Control: In this program were grouped lines of action which involve control of the environmental quality, hence, requiring the management of variable sources of pollution.
4. Programme of Support to the Development of the Plan: Comprises a set of structural initiatives for the implementation of environmental management in the coastal zone. It includes variables types of actions, which range from measures focusing on improvement of administrative issues to sectoral propositions, institutional articulation, information, technological matters, and so forth.

Considering the range of programmes effectively implemented in all lines of action above mentioned, the last PAF (1998-2004) have made several achievements (table 15). Despite the focus given to conflictive issues, the major part of the projects has not concretely focus on mechanisms of conflict resolution. Emphasis has been given to the consolidation of comprehensive basis for risk management and mitigation, especially with respect to the most demanding sectors in the country (e.g. oil exploitation and biodiversity conservation).

With concerns to the occupation and land use planning (Programme 1), Asmus & Kitzmann (2004) considers that a positive evolution the inter-institutional partnership has been consolidated between the MMA and the Office of Federal Heritage - SPU, which has led to a better structuring of the Orla Project. In effect, the MMA have launched five publications<sup>27</sup> aiming to support the implementation and development of the required actions at local and regional level (roadmaps). In practice, Polette (2008) has identified 57 Interventions Plans on the Seafront (Orla Project) along the coastal municipalities and has confirmed that governmental efforts are concentrated in capacity building – the author identified 510 managers of organised civil society, federal and state body trained.

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<sup>27</sup> All publications are available at the MMA website: <http://www.mma.gov.br/sitio/index.php?ido=publicacao>. PublicacoesPorSecretaria&idEstrutura=11

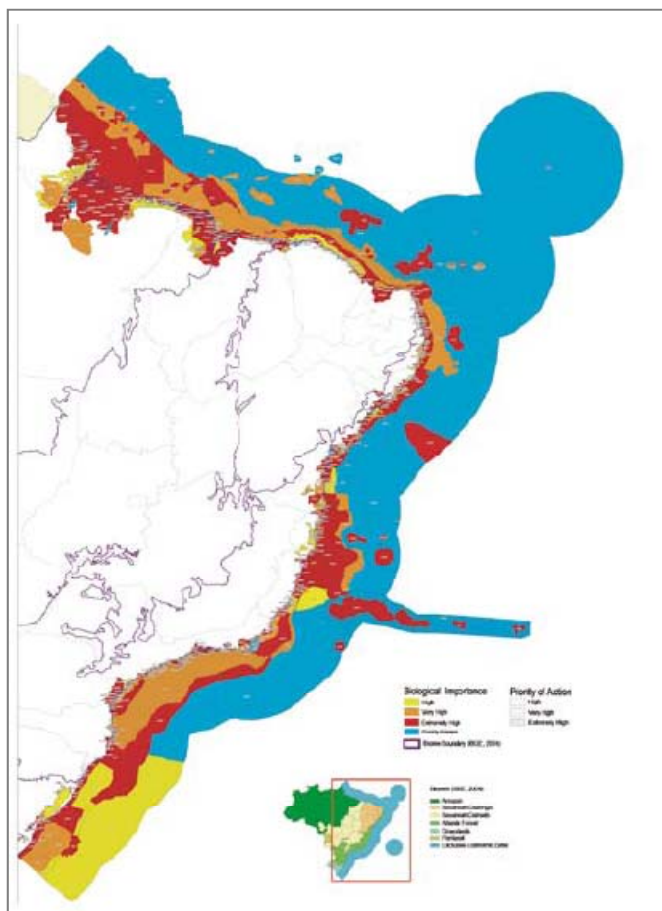


Table 15 - Programmes of the Federal Action Plan for the Coastal Zone (1998-2004).

Federal Action Plan for the Coastal Zone		
Programmes	Lines of Action Projects launched	Results
<i>1. Occupation and Land Use Planning</i>	Orla Project	57 municipalities have developed intervention projects
<i>2. Conservation of Natural, Historic and Cultural Heritage</i>	Management of Areas for Environmental Protection of the Coastal and Marine Zone	Priority Areas for Conservation of Biodiversity on Coastal and Marine Zones
<i>3. Environmental Control</i>	Harbour Environmental Agenda	Train-Sea-Coast programme to support elaboration of local Harbour Agenda  Introduction of ballast water management  Federal Resolution on deposition of dredging materials (Decree n°344/2004)  Environmental Sensitivity Mapping for Oil Spill on Coastal and Marine Zones (SAO Charts)  Areas of Temporary Exclusion of Oil and Gas Activities
<i>4. Support to the Development of the Plan</i>	Review and updating of priorities	--

*Source: CIRM, 2005.*

Considering the actions carried out for conservation of natural, historic and cultural heritage (Programme 2), the most preeminent achievements refers to identification of Priority Areas for Conservation of Biodiversity on Coastal and Marine Zones (MMA, 2007). A national survey was triggered after the establishment of the Decree n° 5092/2004, determining that the Ministry of Environment should set the rules for identification of priority areas for conservation, sustainable use and benefit sharing of biodiversity. It is possible to affirm that this survey has given the most extensive basis of existing knowledge in the field of marine biology, indicating the priority habitats for conservation actions whilst also pointing out areas still not completely covered by systematic studies (figure 15).



*Source: Ministry of the Environment (MMA, 2007).*

Figure 15 - Mapping of priority areas for conservation of biodiversity in coastal and marine zones.

Resources inventories and assessments are widely understood as a worthwhile initiative considering that it is the early step that grounds both forthcoming impact assessment, establishment of management efforts and also allows establishment of indicators of success based on the comparison with previous data (Kay & Alder, 1999). Nevertheless, the CIRM also foresees the possibility of carrying out studies of chemistry, pharmacology and biotechnology applied to marine organisms, generating new knowledge and technologies for the production of pharmaceuticals, biomaterials and other products such as for bioremediation and bioprocess (CIRM, 2008).

With concerns to environmental control (Programme 3), the lines of action are centred on a specific programme focused on capacity building to support the elaboration of local Harbour Agenda, seeking for a behavioural change in a sector characterised as extremely conflictive, in social, economic and environmental terms in the coast and also by its serious impacts on off-shore marine areas (Asmus & Kitzmann, 2004). The introduction of ballast water management and deposition of dredging materials (legally enforced) constitutes an advance in the planning of correlated activities of the sector, also internationally recommended as of high importance issues considering their potential to disturb the marine ecosystem.

Another innovative initiative in the ambit of this programme was the elaboration of the Environmental Sensitivity Mapping for Oil Spill on Coastal and Marine Zones – the SAO Charts – as response to the approval of the Law nº 9966/2000, which assigned to the federal government the liability to identify, locate and define boundaries of ecologically sensitive areas from pollution by oil and other harmful or dangerous substances in waters under national jurisdiction (Polette, 2008). All technical specifications and norms have been supported by the principles and objectives of the national policy of coastal and marine management (MMA, 2008).

The SAO charts currently composes the official basis of information for planning and control the exploration and production of oil and natural gas, also subsiding environmental licensing in the sector. The maps currently available are depicted in strategic, operational and tactical scale:

- Strategic: at scale of 1:500,000, covering the entire area of a given maritime basin or adjoining basins, in case of small basins;
- Tactical: at scale of 1:150,000 for the entire coastal basin mapped;
- Operational or detailed: at scales of 1:10,000 to 1:50,000 for a high-risk/ sensitivity areas.

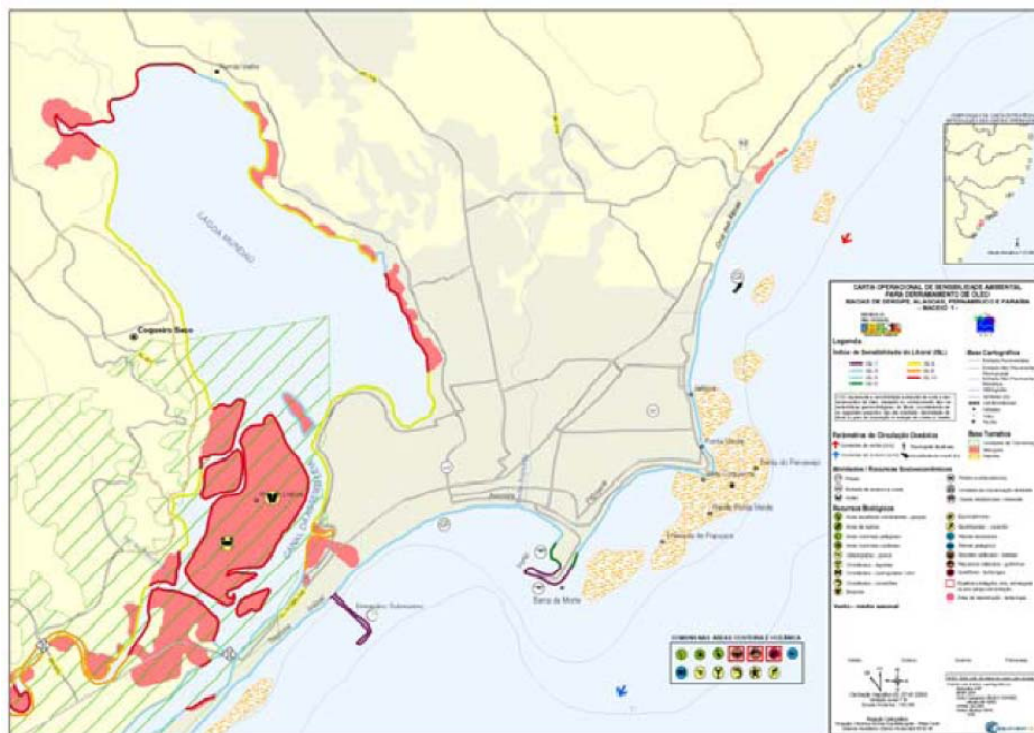
According to the technical specification and norms for mapping production, published by the Ministry of the Environment in 2004, the SAO charts shall include the following information:

- i. Description of the habitats occurring in the coastal and marine region, with their respective index of environmental sensibility (ISL);
- ii. Information on the prediction of behaviour and persistence of spilled oil in these habitats;
- iii. List of biological resources existing in the basin and data on ecological density/ concentration, seasonality, special phases of the life-cycle and information on species protected by law, rare, threatened or endangered;
- iv. Additional information on the socioeconomic activities that can be affected by oil spills in the watershed and offshore marine areas;
- v. Additional data that can facilitate access to impacted areas for response operations (railways, heliports, ports, etc) for possible containing and cleaning up measures.

Currently, have been already concluded the Atlas of the Ceará-Potiguar Maritime Basins (2004), Atlas of the Sergipe – Alagoas and Pernambuco-Paraíba Maritime Basins (2005), Atlas of the Santos Maritime Basins (2005) and the Atlas of the South Bahia Maritime Basins (2005). With such background, the SAO charts are intended to guide operational decision-making regarding protection of coastal marine ecosystems and protection of human life during combat and respond to oil spills, namely, through its incorporation in the National Contingency Plans (PNC – Planos Nacionais de Contingência) and Area Plans for Oil Pollution Avoidance (MMA, 2008). The SAO charts are also foreseen as part of the licensing process for new developments in the oil industry located in coastal and maritime areas under national jurisdiction without the planning, as well as for individual oil companies located on new maritime basins (MMA, 2008).

The maps are still not made available for the general public, even so, some of its applications have already permeating the academic and scientific spheres for further discussion. The example below (figure 16) exemplifies a tactical scale chart, in which the orange areas at sea delimitates places of ecological density/ concentration of species with particular importance. The red areas correspond to

those environments where the Index of Environmental Sensibility (ISL) were assessed in 10 - the highest level – usually indicating presence of mangrove areas, delta of rivers, muddy terrains and other systems characterised by low dynamism.



Source: Cabral et al (2007)

Figure 16 - Example of an Environmental Sensitivity Mapping for Oil Spill on Coastal and Marine Zones (SAO charts) at tactical scale (1:150,000).

Another interesting spatial-based experience also developed in the ambit of the environmental control is the mapping of Areas of Temporary Exclusion of Oil and Gas Activities, whose information was also incorporated into the SAO Charts. This initiative was conceived as an alternative to reduce the potential impacts of seismic activities, drilling of oil wells and installations of pipelines in the marine biodiversity, firstly enforced due to the necessity to protect spawning period of sea turtles in a specific location along the Brazilian coast, considering that all five species that occurs in the country are included in the IUCN list of threatened species (Tamar-IBAMA, 2006<sup>28</sup>). The measure was obviously triggered by strong pressure of the NGO over environmental governmental bodies.

<sup>28</sup> Tamar-IBAMA - TECHNICAL INFORMATION No 02/2006 - Subject: Areas of Temporary Exclusion of oil and gas activities, as measure to mitigation of impacts on sea turtles. Available at: <http://www.ibama.gov.br/consulta/downloads/Informacao%20Tecnica%202002-06%20Areas%20de%20Exclusao%20Temporaria.pdf>

The flexible component of this initiative characterises an innovation on marine planning and management, and constitutes in the first concrete attempt to deal with conflictive activities by using arrangements based on temporal separation of conflictive activities that competes for the same area, which has been seen as an innovative approach specially adopted in the scope of international marine spatial planning strategies (Douvere & Ehler, 2009).

Despite the diversity of innovations and achievements of the Federal Action Plan, its successor document, expected for 2005, is regarded as still under revision by the Integration Group Coastal Management - GI-GERCO, and up to the present has not been launched a new strategy. According to the GI-GERCO (Ata of the 26<sup>o</sup> Ordinary Session) the review of the PAF has seeking, inter alia, for an improvement in its format, particularly with regards to the definition of targets and monitoring indicators for the actions carried out, and have opted for the creation of joint committees for each PAF project, committed to the task of budgetary management, including technical issues such as availability and allocation of human and logistical resources for projects execution.

### 4.2.2. Macro-diagnostic of the Coastal Zone

The Macro-diagnostic of the Coastal Zone have gathered information nationwide concerning physical, natural and socioeconomic aspects of the coastal and adjacent marine areas in order to guide measures of territorial planning, environmental conservation, regulation and control of natural and cultural heritage (MMA, 2008). Additionally, it also intended to provide subsidies for inter-institutional articulation among federal agencies regarding plans and projects involving coastal/marine spaces and resources. The Environmental Ministry understands that a spatial view of such information is an undeniable subsidy to respond to the challenges posed to the coastal planning and management.

The first version of the Macro-diagnostic was released in 1996 after a period of evaluation of the coastal management by the MMA initiated in 1992 during the ENCOGERCO, calling attention to the necessity of an integrated view of the coastal area in order to guide management actions at federal level both in its terrestrial and marine components (MMA, 2008).

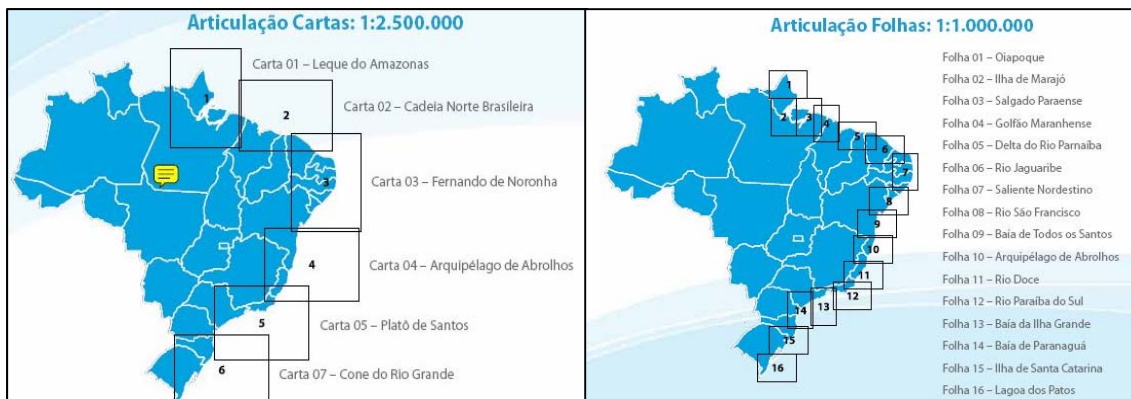
In 2005, an update process was started, aiming to improve the level of information face to the accentuated dynamism with which replacement and expansion of different sectors, policies, plans and programs on the marine and coastal area were made. Furthermore, there been felt necessity of practical instruments to assist the new range of federal demands related to environmental conservation, monitoring and pollution control.

Among the multiplicity of pressure increasingly arising throughout the coast, distinction must be given to the changes felt in the ambit of national energy policy, resulting in a considerable increase in exploration, development and production of oil, mainly in off-shore areas. In this case, the Macro-diagnostic assumed a specific territorial clipping - sedimentary basins – aiming to fit to the demand of the sector in terms of planning focus. The outer ocean limit was given by the Economic Exclusive Zone and the landward by the coastal municipalities.

The Macro-diagnostic of the Coastal Zone is currently presented in the form of an Atlas, consisting of maps and technical reports covering the following topics:

- Geomorphology;
- Population dynamics;
- Oil and gas activities in the Exclusive Economic Zone;
- Marine and coastal biodiversity;
- Potential natural risk;
- Potential social risk;
- Potential technological risk;
- Coastal management.

The scale' analysis of the themes addressed was defined based on the level of detail needed for each approach, although the document is designed to be a composition primarily "on the scale of the Union" (MMA, 2008). The scale of 1:1,000,000 was considered most appropriate for all subjects (except for biodiversity and oil and gas mapping) and has resulted in 16 charts to cover the whole coast; furthermore, at that scale there is fully availability of cartographic databases for the entire coastline. For the exception topics were adopted the scale of 1:2,500,000 (figure 17), resulting in 6 thematic charts. It is worth to mention that the updating of Macro-diagnostic was planned to be later incorporated to the SIGERCO GIS basis.



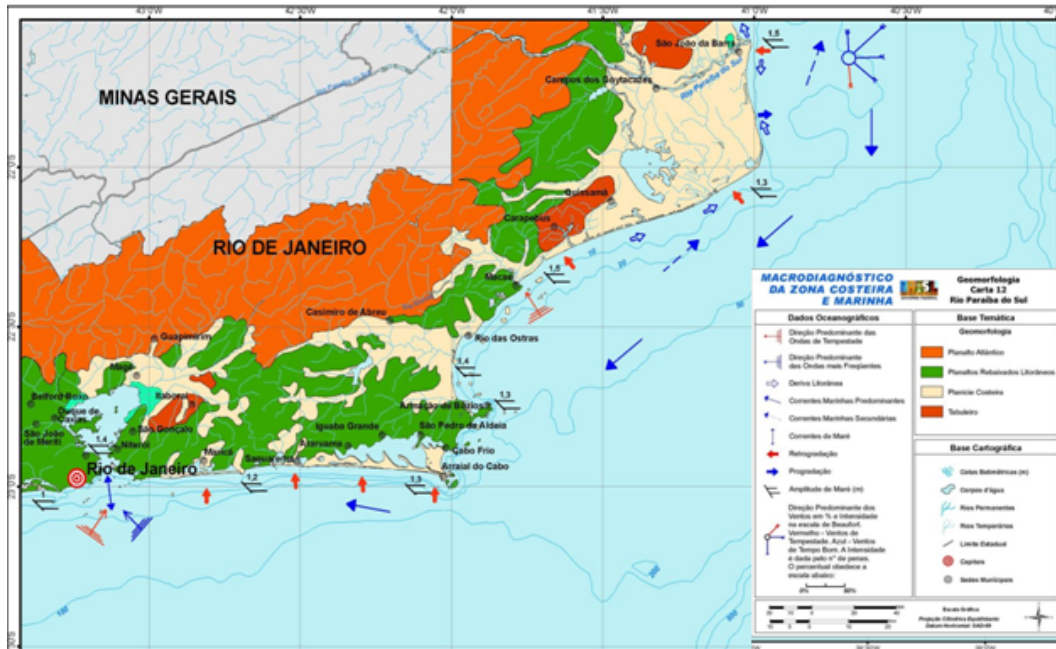
*Source: Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008).*

Figure 17 - Articulation of the maps along the coast assumed by the Macro-diagnostic of Coastal and Marine Zones in Brazil.

Basically, all themes were analysed through aggregation and crossing of data on their respective fields, which is rather useful to direct planning efforts to handle particular issues. The geomorphology of the coastal zone, for example, gave an interesting approach by integrating the major oceanographic processes influencing the coast, such as currents, waves, tides, winds etc,



being also able to provide information about coastal erosion<sup>29</sup>, a problem currently faced by many municipalities. The geomorphology map is showed in the sequence (figure 18), and the red arrows indicate the dominance of erosive processes.



*Source: Adapted from Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008). Zooming of the author.*

Figure 18 - Geomorphology map of Paraíba do Sul River area corresponding to RJ state (Map 12) according to the Macro-diagnostic of Coastal and Marine Zones in Brazil.

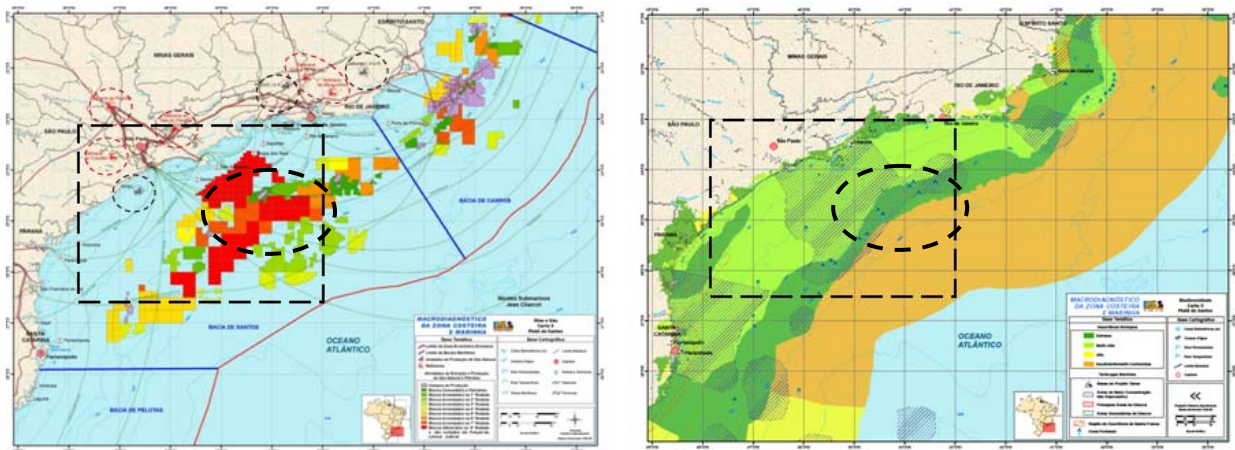
Despite the positive application of such approach in specific subject-basis management – such as is the case of erosion and coastal dynamics, the brochures given by the Macro-diagnostic has presented some limitations to cope with conflicting issues. Similar areas have been dedicated to contrasting uses in different thematic maps, showing an evident superposition of activities and sectors with divergent interests, such was noticed in oil exploitation and identification of priority areas for coastal and marine biodiversity conservation maps. In both cases, all variables of interests where spatially represented into their respective charts, which were not integrated in a later moment, despite an obvious conflict when identical areas of the different thematic maps are superposed (black square interlined in figures 19a and 19b), in which particular zones presenting extreme conflicting objectives (black circles area).

The map on the left side represents the activities of extraction and production of oil and natural gas in the Santos Plateau (RJ state). The exploitation blocks in the marine area are shown in variable

<sup>29</sup> A series of atlas about the hydrodynamics and erosion in the coastal zone of Brazil is available at the MMA website: <http://www.mma.gov.br/sitio/index.php?ido=publicacao.publicacoesPorSecretaria&idEstrutura=78>

colours to differentiate their juridic situation (e.g. lease or bidding processes), but all of them are expected to be fully operative in the next years. The red circles are showing land-based oil industries (refineries) and the black circles the units for natural gas production. The red line bordering the outer oil exploitation area depicts the EEZ and both transversal blue lines limit the Santos's maritime basin.

On the other hand, the map on the right side depicts marine ecosystems of biological importance in the same area - Santos Plateau (RJ state). The dark green represents *extreme* biological importance; soft green *very high* importance and yellow, *high* importance, whereas orange represents *insufficiently known* areas. The green striped zones indicate priority and secondary nursing areas.



Source: Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008).

Figure 19 - Activities of extraction and production of oil and natural gas in the Santos Plateau (a) in RJ state compared with biological importance of marine ecosystems (b) in the scope of the Macro-diagnostic of Coastal and Marine Zones in Brazil.

Although is clear that the aim of the Macro-diagnostic is the construction of a spatial representation of the current situation of coastal and marine areas in Brazil, hence, not being particularly focused in conflict resolution, the illustrative case given above are confronting the major national affairs represented by the energetic sector and biodiversity protection, which would suppose a particular interest to manage this spatial conflict since it that will probably bring up to discussion quite soon. And considering that the basis of information is already available, such analysis of overlapping areas of interest, subsiding forthcoming management measures, could be easily performed.

With regards to the risk assessment subject, the Macro-diagnostic made use of higher integration among variables, including population data as the basic use (human occupation), along with the activities representing the source of risk. The concept of environmental risk was understood as resultant of the combination of different categories of risk (MMA, 2008), separately analysed:



- 
- a) Natural Risk (understood as "flood risk"<sup>30</sup>): related to processes and events of natural origin or induced by human activities.
  - b) Technological Risk: it is limited to the context of production processes and industrial activity. The notion of technological hazard arises principally from industrial technology, derived from internal faults.
  - c) Social Risk: it is a category that can be analyzed and developed by different biases. The Macro-diagnostic adopt the bias in which “(...) *the social risk is seen as resulting from social deprivation to fully human development, which contributes to the deterioration of living conditions*” (MMA, 2008). Its manifestation was measured in terms of access to basic services such as clean water, sewage, and solid waste collection.

The natural risk map considered the information available about the erosive characteristics of the Brazilian coast (geomorphology map), added to other variables related to flood risk potential (population and terrain altimetry). The weighting of factors took into account the combination of such variables, and elevations below 10m with the presence of erosion process were considered the most critical indicator of vulnerability to floods. The potential risk was then evaluated from the crossing of the vulnerability areas within population data by sub-district.

This set of information was designed to provide important feedback to planning mainly with relation to the regulation of land use and surveillance of public and cultural heritage along the coast, aiming to ground forthcoming management measures to avoid or reduce human and patrimonial loses along the coast derived from flooding events (MMA, 2008). The figure 20 illustrates the situation of natural risk for the same area of analysis, Paraíba do Sul River area, corresponding to the Santos Plateau, in Rio de Janeiro State. The natural risk is represented in a scale of colours from red, representing *very high* risk areas, from green, *very low*. The red narrows continues to represent erosive process.

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<sup>30</sup> The Macro-diagnostic stresses that about 55% of natural causes with events that reached Brazil from 1948 to 2006 were related to river flooding and / or advances of the sea (International Disaster Database - OFDA / CRED - [www.em.dat.net](http://www.em.dat.net) - Université Catholique de Louvain, Brussels, Belgium)

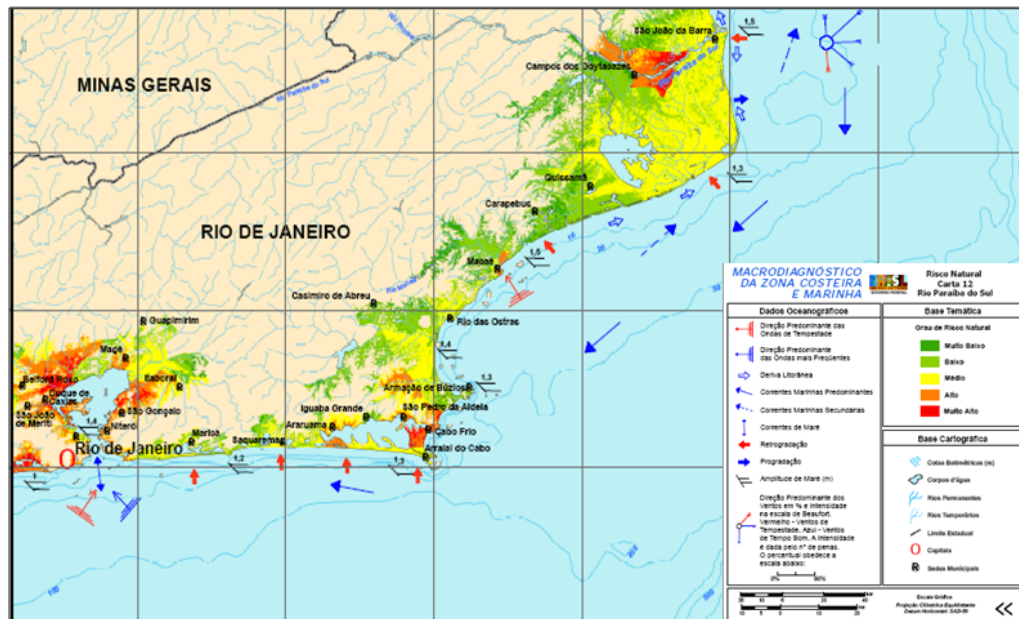
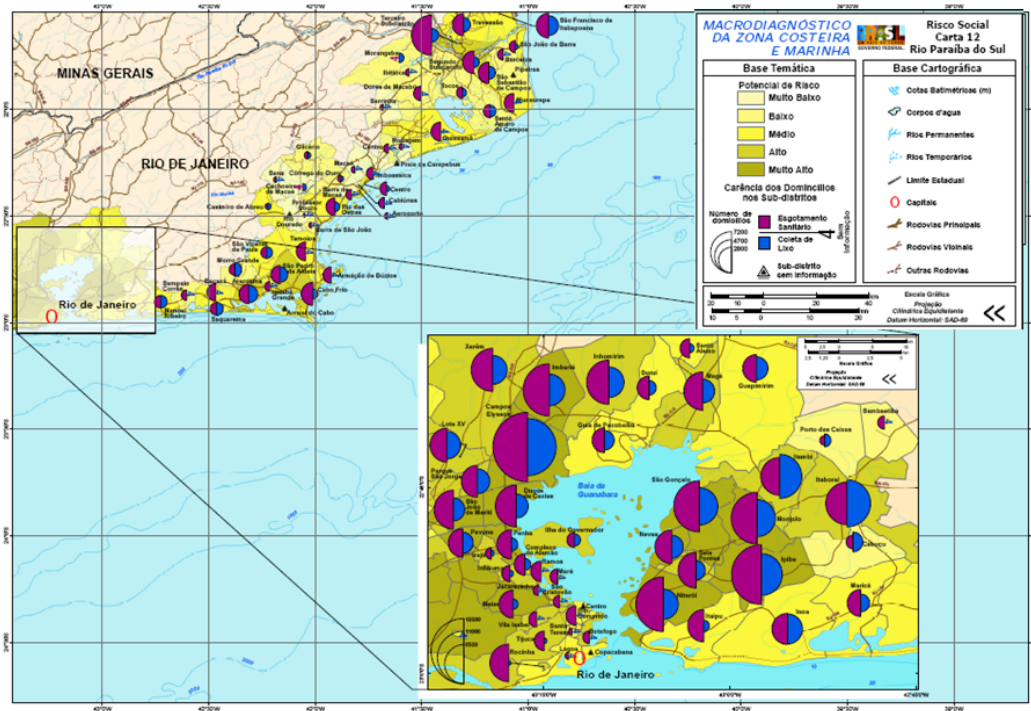


Figure 20 - Natural risk of Paraíba do Sul River area in RJ state (Map 12) according to the Macro-diagnostic of Coastal and Marine Zones in Brazil.

Surprisingly, accurate statistics of basic sanitation in Brazil are still recent despite the well-known magnitude of the problem. The set of available data were compiled for the study, and the social risk chart is showed in the figure 21.

The approach given does not seem exactly appropriate for planning and management purposes, since the data are presented in a confuse manner, firstly focusing on households with basic services, and later, attributing the condition of risk to those without the same services. Furthermore, the number of households supplied by the services per sub-district is just a figure, and do not recognise the total number of households in the region, therefore, do not allowing inferences about

the number of homes without such service (despite this figure is used to ground the indication of potential risk areas). The percentage of households without such service would be more informative, pointing out municipalities with critical conditions, thus, under higher social risk, which would be desirable to give priority for investments in basic services supply in that region, simplifying the analysis.



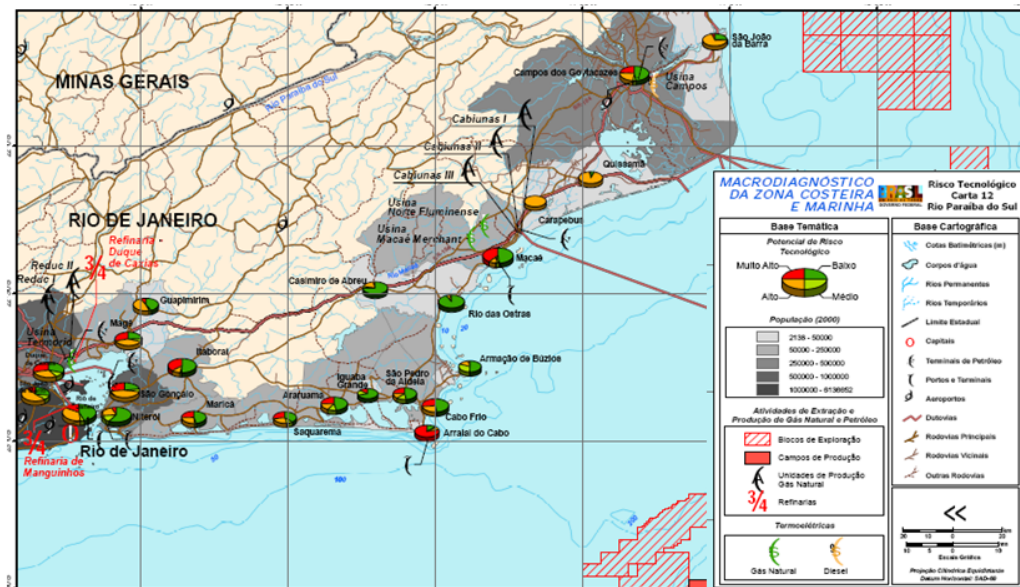
Source: Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008). Zooming of the author.

Figure 21 - Social risk of Paraíba do Sul River area in RJ state (Map 12) according to the Macro-diagnostic of Coastal and Marine Zones in Brazil.

The technological risk analysis was defined as the potential of occurrence of harmful events to life, in short, medium and long term. In this sense, it can be interpreted as a result of investment decisions in the productive structure installed in the coastal and marine areas (MMA, 2008). The concept involves an evaluation of both the probability of critical events of short duration with large consequences, such as explosions, leaks or spills of toxic products, in addition to long-term contamination of natural systems for release and disposal of waste from the production process.

The risk analysis considered information concerning the spatial distribution of main industries, which were aggregated according to their potential of pollution (in accordance with a methodology proposed by the Annual Relation of Social Information (RAIS) of Ministry of Labour). This information was crossed with the number of employees in the industrial sector per municipality, and also with total population, giving a notion of quantity of people potentially affected by an accident involving technological risk.

The data obtained from the crossing of the range of information has been grouped into four intervals of classes that represent the potential technological risks – *low* (dark green); *medium* (soft green); *high* (orange) and *very high* (red) – graphically depicted in the figure 22. The number of total population endangered in case of technological accident was also divided into classes, showed in a scale of gray, where the darker colour indicates up to 6 million peoples affected.



Source: Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008). Zooming of the author.

Figure 22 - Technological risk of Paraíba do Sul River area in RJ state (Map 12) according to the Macro-diagnostic of Coastal and Marine Zones in Brazil.

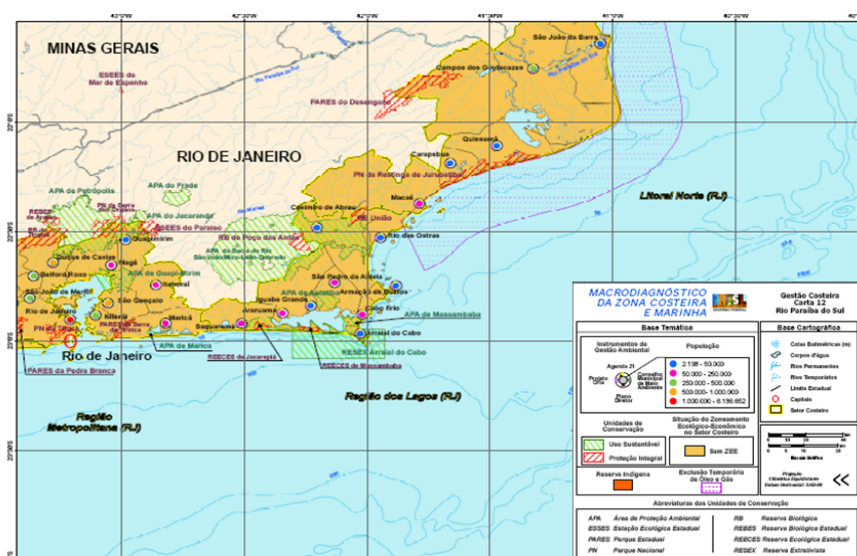
The map also locates off-shore blocks of oil exploitation and network of pipelines (missed in the zoom), and in the coast, oil refineries, thermoelectric units, units of natural gas production and network transportation, ports, harbours and roads, qualifying a comprehensive spatial basis to subsidy management measures seeking for human and environmental safety. In that sense, is reasonable to affirm that users vs. environment conflicts have gained a potential contribution for future action, subsidising development of evacuation plans, establishment of a maximum perimeter for industrial areas, isolating residential areas (zoning), among others. In the case of contingency plans for accidents at sea (e.g. oil spills), the present map could be easily improved by addition of geomorphology data, allowing further inferences related to patterns of dispersion of the pollutant, residence time in bays, and so forth.

With concerns to the coastal management thematic map, the Macro-diagnostic aimed to present, spatially, the panorama of the conjunct of federal policies and actions related to the promotion of planning and management along the coastal zone. Nevertheless the document itself explained that

the set of policies covered does not comprise the totality of government initiatives, but emphasise those that embraces key environmental issues and represents the major instruments of territorial planning currently employed in the coastal and marine areas. According to the document, the most promising initiatives of the federal government towards the coastal management in Brazil have been the follows:

- Orla Project;
- Agenda 21 (municipalities);
- Municipal Environmental Councils;
- Ecological Economic Zoning;
- Areas of temporary exclusion of oil and gas exploration;
- Protected Areas;
- Environmental Oil Sensitivity Mapping (SAO Charts);
- Population data for coastal municipalities.

The analysis of the integrated management of the coastal and marine zones developed by the Macro-diagnostic in Brazil demonstrates that several advances have been experienced. The implementation of protected areas is seen as one of the major advances in terms of support instruments of planning and management of coastal and marine resources. Protected areas are showed in the map of coastal management (figure 23) - the striped areas in the map below (in red and green) show the delimitation of different categories of management (full protection and sustainable use, respectively), either located at land or sea. The lilac dotted area in the sea corresponds to the Area of Temporary Exclusion of Oil and Gas activities. In the land, the soft orange area indicates the absence of the ZEE in the coast whilst dark orange correspond to indigenous reserves.



Source: Macro-diagnostic of Coastal and Marine Zones in Brazil (MMA, 2008).

Figure 23 - Coastal Management in Paraíba do Sul River area in RJ state (Map 12) according to the Macro-diagnostic of Coastal and Marine Zones in Brazil.



Support to municipalities is also regarded as of fundamental importance and interesting advances were reported at local level, especially, with regards to the development of their respective management plans/measures such as the Orla Project, Agenda 21 and Environmental Councils, which lead to the strengthening of the municipal role to support the coastal management policy. The adoption of such initiatives by coastal municipalities is presented in the table 16 (MMA, 2008).

Table 16- Development of Orla Project, Agenda 21 and Environmental Councils by coastal municipalities

Region	Orla project	Agenda 21	Environmental Councils
<i>North</i>	8%	50%	18%
<i>Northeast</i>	10%	71%	43%
<i>Southeast</i>	28%	81%	66%
<i>South</i>	20%	68%	63%

In effect, it is sound to affirm that the Macro-diagnostic represents the first national effort focused on identification of management demand through an integrated analysis of a wide range of spatial information. Besides the greater volume of data, the resultant spatial profile will be of fundamental importance to driving forthcoming planning and management actions in the country. It represents a remarkable advance considering that some of these tools have been never applied in official diagnostics and just recently have been really performed (MMA, 2008). Furthermore, the macro-diagnostic has included risk management as an additional dimension of analysis, which can be seen as a very positive aspect of this initiative.

In effect, despite both federal lines of action – the PAF and the Macro-diagnostic – do not being particularly focused in resolution of conflicting interests, the proactive approach and employment of spatial techniques is expected to be able to promote an adjustment of decision-making to the real demands, also encouraging and giving subsidies for realignment of plans, programs and investments in the coastal and marine areas, thus, contemplating the range of sectoral intentions in a later moment.

With regards these approaches chosen by Brazilian government, it is clear the emphasis given to resources inventories and mapping, mainly with the function of area planning, promotion of economic development and stewardship of resources. Furthermore, marine and coastal issues were addressed in an integrated manner, and in a positive approach, which variable spatial scales allowing an appreciation of the pressures and driving forces that have influenced its dynamics, including those that come from outside of the local area.

The role and action of federal government in managing strategic coastal and marine resources has indicating high potential to promote a more appropriate management of these areas, specially with concerns to the marine space since the pressures are still emerging, and conflicting interests are still able to be properly handled.

### 4.2.3. Marine Protected Areas as instruments of planning at sea: recent achievements

Besides the regulations attached to coastal management prescriptions, the proliferation of coastal and marine protected have resulted in a particular planning and management approaches for those environments, in accordance with its legal basis – the National System of Protected Areas (SNUC) -, which have conceptualised a particular range of objectives and tools to support decision making.

Currently in Brazil, there are 91 protected areas in marine areas comprising exactly 1,860 million of hectares (ha), about 18,600 km<sup>2</sup> (MMA, 2007). Among those, 38 are marine protected areas (MPA) of full protection covering around 417, 900 ha, whilst the protected areas of sustainable use accounts with 53 units, comprehending almost three times the totality of no-take areas (1,433,000 ha). The current situation of protected areas in national territory, described by category of management, jurisdiction and geographic scope is shown in the table 17.

Table 17 - Terrestrial and marine protected areas in Brazil, described by category of management and jurisdiction

Management Category	Jurisdiction*	Number of UC	Area (hectares)	Terrestrial UC		Marine UC	
				Number	Area (ha)	Number	Area (ha)
<b>Full Protection (No-take)</b>	Federal	128	33,238,200	104	32,829,100	24	409,100
	State	184	8,365,000	170	8,356,200	14	8,800
<b>Partial</b>		<b>312</b>	<b>41,603,200</b>	<b>274</b>	<b>41,185,300</b>	<b>38</b>	<b>417,900</b>
<b>Sustainable Use</b>	Federal	164	35,491,500	136	34,434,300	28	1,057,200
	State	124	21,755,800	99	21,380,000	25	375,800
<b>Partial</b>		<b>288</b>	<b>58,247,300</b>	<b>235</b>	<b>56,814,300</b>	<b>53</b>	<b>1,433,000</b>
<b>Total</b>		<b>600</b>	<b>99,850,500</b>	<b>509</b>	<b>97,999,600</b>	<b>91</b>	<b>1,850,900</b>

Source: MMA (2007).

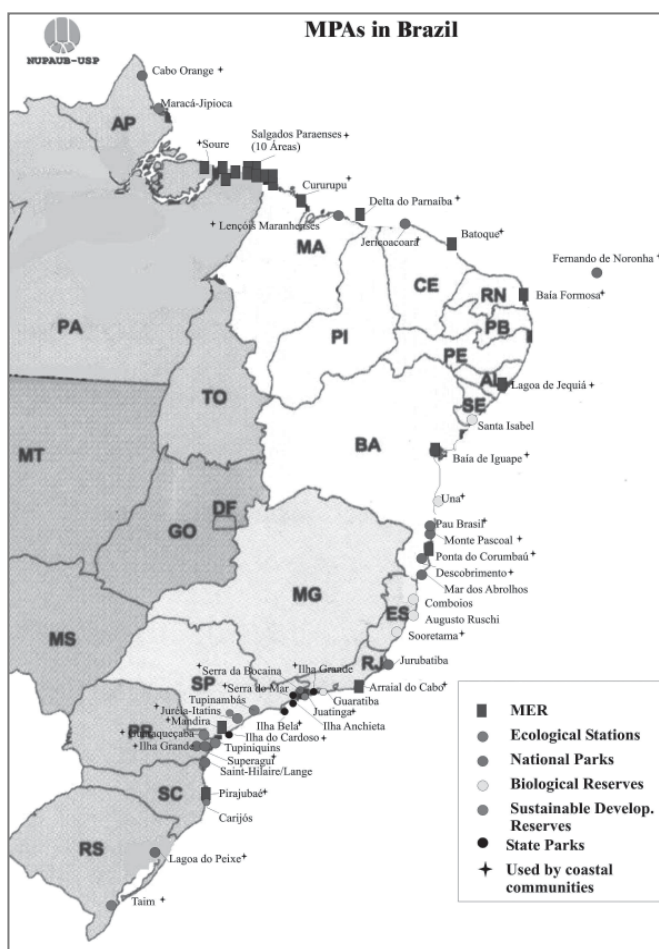
\* Protected Areas at Municipal level are not included yet in the database.

Diegues (2008) have recently mapped the location of the marine protected areas along Brazilian coast, also locating places where the resources have been used and managed by coastal communities, although not yet under a legal frame (figure 25). In the following figure, Marine RESEX category is referred as MER (acronym in English standing for Marine Extractive Reserves).

The number of MPA depicted in the figure does not correspond exactly to those presented by IBAMA (2007), the official source. The reason for such inconsistency was not identified. Anyway,

both references illustrate the numeric and geographic significance of protected areas the country, assuring particular efforts for planning and management at coastal and marine spaces.

Despite the proliferation of MPAs along the national coast, the number of UCs which has made use of its legal instruments of management (Council, Management Plan and Zoning) is not compiled by official statistics. Contrasting with the large number of MPAs existent and being created in Brail, there is a lack of studies evaluating their current level of implementation or effectivity as instruments of planning and management at sea. The majority of related literature available is socio-environmental diagnostics performed to support the creation of the MPA and/or for elaboration of its management plan (Seixas & Kalikoski, 2009). The other ranges of studies identified are assessments towards social implications of MPAs and their potential to improve fisheries management (MMA, 2007<sup>31</sup>; Diegues, 2008; Seixas & Kalikoski, 2009; Kalikoski *et al.*, 2009).



Source: Diegues (2008).

Figure 24 - Different categories of marine protect areas and their location along Brazilian coast.

<sup>31</sup> Aquatic Protected Areas as Fisheries Management Tools. Protected Areas of Brazil Series, 4. Prates, A. & Blanc, D. (orgs.). Brasília: MMA/SBF, 2007. 17-24pp.



Even in light of such background and with the first marine reserve created in 1979<sup>32</sup>, the planning and management of marine protected areas marine is still reported as a relatively new subject in Brazil (Fournier & Panizza, 2003; Carvalho, 2007; MMA, 2007). Consequently, specific tools for its management are still under development.

These authors have acknowledge that the methodology for elaboration of the management plan and zoning in UCs have its origins, hence, is primarily focused on the terrestrial biome, which might cause shortcomings when applied to marine areas, characterised by its tri-dimensionality (Carvalho, 2007). When a tri-dimension environment is conceived in a bi-dimensional plane, its vertical component is forgotten; therefore, the scope of possibilities to meet multiples uses in a given area through the differentiation of surface, water column and seabed is greatly restricted.

In practice, MPAs in Brazil have promoted different tools that limit, forbid and control use-patterns and human activity through a variable structure of rights and rules (Diegues, 2008). Its evolution is occurring in the present and is certain to evolve faster gaining with experience, especially if learning from international experiences on the theme.

The application of the first tri-dimensional approach in a no-take MPA is described in turn, aiming to illustrate how this field in Brazil have incorporated, in practice, the management of sea uses and to which array of interests they have responded. A final discussion aim to observe to which extend no-take management initiatives have been able to internalise international prescriptions in the theme.

### 4.2.3.1. The first tri-dimensional zoning approach in the Arvoredo Marine Reserve Island, SC, Brazil.

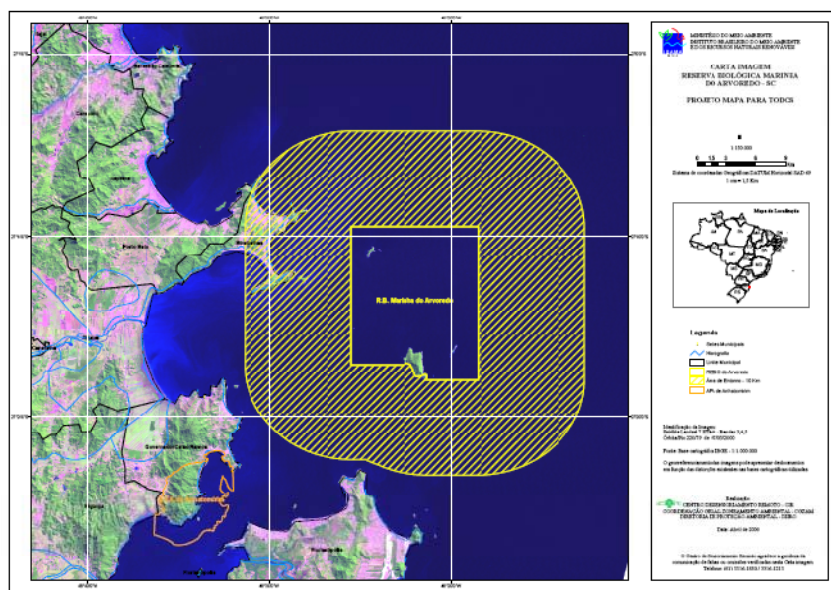
In Brazil, the application of a tri-dimensional zoning has been only recently described, and despite of being a simple and initial attempt to do that, it will probably call attention to the potential of manage multiple uses by adopting the ocean profundity as component of planning. The initiative was carried out in the Marine Biological Reserve of Arvoredo, no-take reserve created in 1990 with the objective to protect a group of islands and their representative species of local marine ecosystems, with some endemic species such as a bank of calcareous algae (Carvalho, 2007). The MPA consists of four islands: Arvoredo, Deserta, Galés and Calhau of São Pedro (figure 26), located around 7 km seaward from the Santa Catarina state, south of Brazil. The yellow area delimitates a 10km buffer zone, and the internal square correspond to the area comprised by the protected area, connecting the islands.

Among the categories of conservation units established by SNUC, Biological Reserve is the most restrictive - the access to natural resources is allowed only through environmental education and scientific research - restrictions that are often the cause of conflict involving reserve management objectives and local communities (SNUC, 2000).

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<sup>32</sup> The Marine Biological Reserve of Atoll das Rocas was enacted by the Decree nº 83549/1979, and constituted an attempt to preserve the only atoll in Brazilian waters and their associated biodiversity (Carvalho, 2007).

In fact, during the preparation of the management plan of the MPA, in the scope of the Advisory Council, in 2002, a series of conflicts were identified, whose management suggested the possibility of differentiating the purposes of use over the surface, water column and bottom of the sea by using a tri-dimensional zoning - named ZATRI by the initiative (Carvalho, 2007). The author elucidates that the major international reference in that regards was the Management Plan of the Great Barrier Reef Marine Park.



Source: IBAMA - MMA - Project maps for all. Available at: [www.siscom.ibama.gov.br](http://www.siscom.ibama.gov.br).

Figure 25 - Delimitation of the Marine Biological Reserve of Arvoredo – Santa Catarina State, Brazil.

The elaboration of the plan carried out by the Advisory Council was developed with direct involvement of the surrounding communities, beginning with the identification of local use conflicts. In particular, the major difficulty was the compatibility with fisheries activities in the surroundings of the MPA, mostly related to their navigation routes and anchor sites. The other set of pressures identified were related to land-based activities - dumping of waste and effluents into the sea by local industries of leather, footwear, ceramics and mineral extraction, and the existence of an off-shore oil reserve in the vicinities of the marine reserve (Carvalho, 2007). The local conflict deserved first attention in the zoning process, since it involves direct users in the region being able to be handled by the management plan. The other set of impacts would require different legal measures, not able to be readily addressed by the plan.

According to Carvalho (2007), the issue of navigation route arisen because the fishermen felt prejudiced by the difficulties of access to open seas, no longer made in a straight line since the definition of MPA that jointed the islands as a whole marine protected area. They claimed the right of access to the MPA area to track the same route historically used, positioned between the islands of Arvoredo and Galés, affirming that was the safest and shorter connection between the land and

high sea. The relevance of the issue was related to the importance of the travel time and fuel consumption when accessing fishing areas on the high seas, which represents an important factor for the economic reproducibility of fisheries.

The discussion about anchor sites involved the use of a sheltered bay in an area named Porto Norte for anchoring of fishing boats, mainly in case of the usual storms during the winter. The same area was the preferred one by local diving operators, which established a nautical tourism due to the presence of the calcareous algae bank in an area of suitable access for underwater activities (Carvalho, 2007).

Despite the situation did not involve high stakes (e.g. strong economic sectors) or direct and substantial impacts - after all, the interests converge to the use of local natural resources - the management plan and zoning were the instruments designed to seek for a plausible accord, although considering the conservation as priority objective. In that sense, the proposal to separate marine areas in its vertical component (sea surface, water column and seabed) indicated the possibility of harmonisation of different uses at the same geographic point, regardless the high level of protection involved.

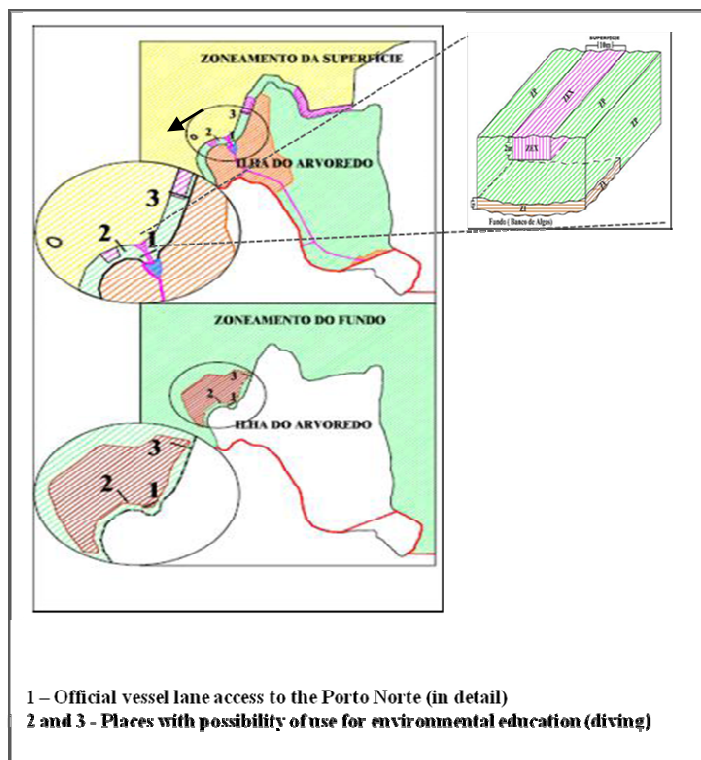
Through zoning, the impasse achieved a compromised solution. For the anchoring of boats in the Porto Norte, there were defined a vessel lane access throughout the islands, following the traditional route, and a anchoring area before the occurrence of the calcareous algae bank, which was understood as an environmental asset that required an area of greater protection. In the case of diving and nautical activities, was raised the possibility of implementing an environmental education programme directed to an adjacent area which would be promoted as part of the MPA environmental educational activities, therefore legalised, since it could be included in the planning (Carvalho, 2007).

In short, the zoning of the Porto Norte was the follows: in the surface waters were established two tracks with depths of 2 m and 3 m. The first one (2 meters deep) should be the official vessel lane access to the Porto Norte, where it would be the installed the administrative unit of the MPA, facilitating the monitoring of that area identified as the most demanding one. The second track (3 meters deep) was exclusively to support the development of an environmental education diving program. From the seabed up to 1 meter was established an intangible zone, providing greater protection to the bank of calcareous algae. In that area, no anchoring or diving could be made.

With respect to the land-based sources of pollution, despite the inclusion of a territorial portion in the buffer zone of the MPA (see figure X), these problems could not be managed only by using the instruments foreseen in the SNUC. It was decided to consolidate more precise information concerning the likelihood of contamination of the MPA in case of oil spills at sea, etc. (Carvalho, 2007). The same decision was considered to cope with the residues coming from coastal industries.

Although constituting the first tri-dimensional approach in Brazil, the experience was not equally efficient to translate its results into spatial products. The figure 27 represents the zoning scheme adopted in the MPA for the Porto Norte. The figure on the left (above) depicts the surface zoning,

showing the areas where conflicting uses were managed. The anchoring area is showed by the black arrow. The figure bellow depicts the seabed zoning, delimitating the calcareous coral bank as intangible zoning. On the right side, a tri-dimensional view of the surface zoning scheme is provided, showing the official vessel lane access to the Porto Norte, of 2 meters deep.



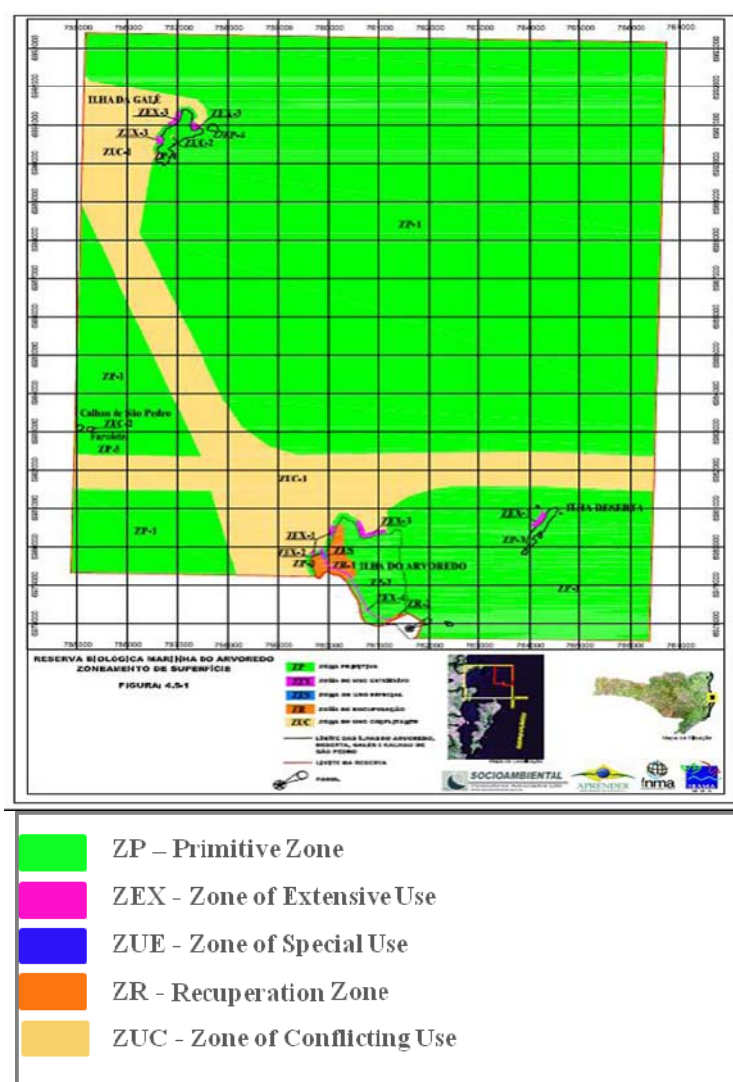
Source: Carvalho (2007)

Figure 26 - General aspect of the Porto Norte zoning of the Marine Biological Reserve of Arvoredo, SC, Brazil.

The general zoning adopted for the marine surface is depicted in the following map (figure 28). The categories of zones used correspond to those recommended by the IBAMA for the planning of Full Protection UC (IBAMA, 2005).

The main difficulty reported by Carvalho (2007) was related to establish, in practice, the limits of the zones - at sea, the lack of natural references make difficult the identification of the boundaries of the areas either horizontally or vertically. In fact, the difficulty of setting zones in the ocean is a topic inherent to marine spatial planning discussions (Gubbay, 2004; Ehler & Douvere, 2009).

Carvalho (2007) also mention some inadequacy found when applying terrestrial-based guidelines to the marine environment. According to the author, in order to improve the applicability of the zoning to local reality there were created seven new criteria based on particular issues locally identified, and several of those proposed by the roadmap for planning a full protection UC were not used.



Source: Carvalho (2007)

Figure 27 - Zones established for the marine surface of the Marine Biological Reserve of Arvoredo, SC, Brazil.

However, is essential to the managers to born in mind that any roadmap is general by its nature, being able to gives common guideline for primary basis of planning - which is in fact desirable and internationally recommended. But is of common agreement that the particularities of each conflict are better addressed when the solutions are tailored to the local reality (Cicin-Sain & Knecht, 1998; Kay & Alder, 1999; Maes *et al.*, 2005)

As general conclusion, the management plan of the Rebiomar of Arvoredo indicates that an efficient zoning effort in marine area should consider its three-dimensional plane, with specific physical, chemical and biological characteristics varying along its vertical component. Therefore, considering that different features usually attend to different interests/ necessities of use, the

management of multiple spatial claims associated with the marine resources and spaces are greatly improved.

In that particular case, local conflicts were the immediate focus of management readily benefited from the tri-dimension approach, whilst indirect conflicts required a more strategic approach to involve the related sectors, indicating that involvement of users and common agreement are mandatory features for a well-succeeded planning effort.

In effect, the three-dimension planning rationality originally emerged in the ambit of protected areas, in Australia, and currently is worldwide employed as marine management tool. This situation is a clear example that international context not only promote legal enforcement for issues of global importance, as MPA, it has also provided the practical elements for achieving better results, mainly due to the “sharing” of best practices currently introduced also at policy-making level.

### **4.3. Informal mechanisms of conflict resolution at sea: collaborative fisheries management**

In contrast to MPAs, in which planning and management instruments are determined by the legal frame of SNUC, participative fisheries management are characterised by a variety of approaches, methods, objectives, and outcomes of planning and management (Seixas & Kalikoski, 2009). The main variable conditioning all those characteristics are the institutional arrangement of which it is part of, i.e. the broad context in which the initiative has came up (e.g. governmental programme, social mobilisation, protected area), what are the institutions involved and finally, what are the users and interests at stake.

In turn, the analysis moves towards the situation of participatory fisheries management in the country, describing some positive results achieved in the management of sea uses and once more looking for its spatial results and products evidencing to which array of interests they have responded.

#### **4.3.1. Scope of co-management experiences in Brazil**

Recent evaluation undertaken in Brazil has shown the variety of institutional arrangements by which fisheries participatory management have been instituted, which will determine the range of objectives, tools and rationalities guiding planning efforts.

Kalikoski *et al.*, (2009) identified a concentration of co-management initiatives in the northern region more than in any other region of Brazil, and almost exclusively occurring in the coastal area in the ambit of conservation units (protected areas). In the northeast, southeast and south, there are few initiatives, and those carried out in the coastal regions are mostly independent of protected areas (for example, through forums and sectorial discussions).

Despite the multiplicity of institutional contexts, two points become clear in the concerned literature and must be emphasised. Firstly, that conflicts or competition involving the use of fishery resources is the major cause triggering discussion, agreements and collaborative management instances. Secondly, there is no general mechanism to achieve an agreement on the use of resources; the similarity is just the engagement of resource users in management processes.

The variable expressions of participatory fisheries management initiatives in Brazil can be differentiated, mainly, by its inclusion in protected areas or not, since it is the primary factor determining the range of planning and management methods to be adopted.

In the scope of protected areas, participatory fisheries arrangements have occurred both in Full Protection and Sustainable Use UC. Out the UC domain, there have been variable types of fisheries agreements, forums, governmental projects and other proposals of participatory fisheries management.

Seixas & Kalikoski (2009) identified one case of participatory management within UC of full protection in coastal/marine waters in the State Park of Cardoso Island, SP created in 1962, where a Committee of Participatory Management was instituted in 1998, but is still in phase of implementation.

With respect to UC of sustainable use - whose objective is exactly to promote a collaborative management - were identified only two cases in marine areas where such premise has operating in an effective manner: in the Marine Extractive Reserve of Mandira, SP, created in 2002, where the co-management is reported as implemented; and in the Marine RESEX of Arraial do Cabo, RJ, created in 1997, comprising coastal and offshore waters, where the co-management is refereed as implemented, monitored and evaluated. In other three Marine RESEXs the participatory arrangement is under phase of construction. Diegues (2008) adds to that list the Marine RESEX of Corumbau, BA, established in 2000, which has consolidating the deliberative council and is drafting a management plan to supports users' active participation in the management of the area.

With respect to experiences undertaken out of protected areas, the only Fishery Forum effectively operating is the Forum of Patos Lagoon, RG, created in 1996, comprising a coastal lagoon part of an estuary. This case is reported as already implemented, monitored and evaluated (op.cit.), and also mentioned as the most studied case so far and is certainly covering the largest area of management (Kalikoski *et al.*, 2009).

On the other hand, fisheries agreements have been applied, in practice, only in interior waters (lakes and rivers), specially in the Amazon Region, being reported as the main instrument of conflict resolution contributing to drive fisheries policies and action research projects in the Amazon region (MMA, 2007). They have arisen in the ambit of governmental projects particularly focused on improvement of participatory fisheries management, specially commissioned in the scope of the Project on the Meadows' Natural Resources Management<sup>33</sup>, involving riparian communities, fishermen colonies (representative body) and NGOs (MMA, 2007; Seixas &

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<sup>33</sup> Projeto Pro-Várzea/IBAMA - More information available at: [http://www.ibama.gov.br/provarzea/index.php?id\\_menu=0](http://www.ibama.gov.br/provarzea/index.php?id_menu=0)

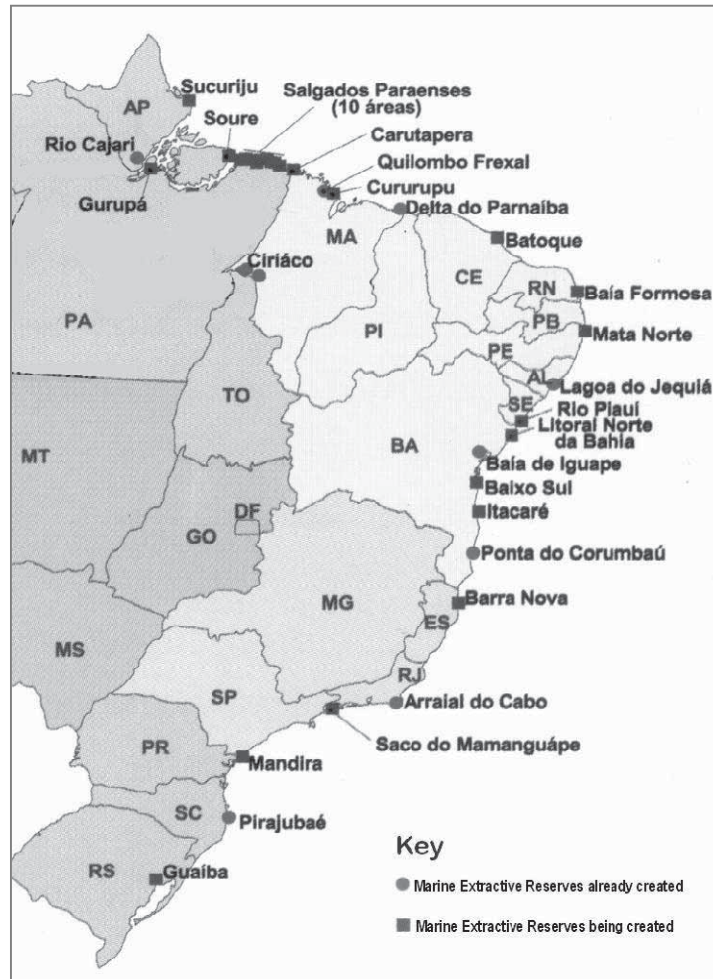


Kalikoski, 2009). These agreements have defined rules of use and access to fishing resources in particular areas, usually with defined borders (such as floodplain lakes) which are later enacted by IBAMA through specific regulations (op. cit.).

In the coastal and marine areas, the predominance of participatory fisheries management proposals regardless the UCs, have arisen from mobilisation of users, directing efforts toward conflict resolution involving variable resources, such as mangrove harvesting in Bragança (Pará, north region) (Krause & Glaser, 2003); lobster fisheries in Ceará (northeast); crab harvesting in the southeast and south region; artisanal fisheries in Saquarema Lagoon, RJ, in the southeast (Seixas & Kalikoski, 2009). According to the authors, all cases are under consolidation of the participatory basis for management.

Despite the existence of all sort of schemes identified in the literature, the Marine RESEXs still represents the most promising field for development of effective practices of fisheries co-management, since its shape and instruments is already supported by law and the Brazilian Government, enforcing and guaranteeing its practice. According to Diegues (2008) there are 17 Marine Extractive Reserves in Brazil, spread in nine Brazilian States along the whole national coast, and holding about 28,250 artisanal fishers. Besides those, about 68 Marine RESEX have been proposed and are currently under IBAMA's consideration. If accepted, 15 of the 17 coastal states will have a Marine Extractive Reserve (op. cit). The totality of Brazilian Marine Extractive Reserves, including those already created and in the national coast in the following map (figure 29).





Source: CNPT, IBAMA from Diegues (2008).

Figure 28 - Location of Marine Extractive Reserves along Brazilian coast

Pinto da Siva (2004), who evaluated the management arrangements in the RESEX of Arraial do Cabo, have evidenced a complex set of norms including restrictions on the type of gear, vessel and number of crew that can participate in local fisheries, mainly instituted by the local community. The authors state that, despite the traditional use of such norms prior to the consolidation of the RESEX, the social order has been recently threatened by increasing introduction of non-local commercial fishermen in the local scheme. On the contrary, a positive result is related to the identification of preferred areas for different species, which were performed as part of the multiple use management plan, offering a primary basis over which access rights and uses' regulations have been discussed.

Another category of sustainable use UC has making use of spatial zoning for fisheries management purposes. In the Environmental Protected Area of Costa dos Corais (APA Costa dos Corais in Pernambuco state), the zoning dedicated two no-take areas to enhance the recovery of biodiversity and fishing potential of the UC as a whole (Ferreira & Maida, 2007). According to the authors, an

increasing in some fisheries population of commercial importance was seen in the first year, being much higher in the no-take zones than in the adjacent areas (op.cit).

The use of marine no-take zones have been increasingly acknowledged as one of most efficient strategies for fishery management in Brazil (Prates *et al.*, 2007). It has been also used as main alternative in the process of participative management of professional artisanal beach fishery of the North Coast of Rio Grande do Sul (Peres *et al.*, 2007). In this case, the zoning foresaw the creation of no-take zones trying to protect critical areas for biodiversity conservation seeking for fisheries stocks recovery. Prohibition of fishery gears for fishing endangered species were also one of the measures proposed during several participatory meetings carried out in the region.

Such experiences are just an indicative of the potential of local communities to offer supporting elements guide the formulation of new experiences towards the management of marine resources.

Among the challenges in implementing arrangements for participatory fisheries management, some authors have stressed the existence of conflicts between different scales of interest regarding the use, extraction and management of resources, such as between commercial *vs.* industrial fisheries; between artisanal fishing *vs.* large-scale aquaculture; between groups of fishers using different types of gear and so on (Jabloski & Filet, 2008; Diegues, 2008; Kalikoski *et al.*, 2009).

Kalikoski *et al.*, (2009) also identified multiple activities developed in order to strengthening the organizational structures and capacity of local communities to manage resources in a satisfactory way. Among those, a key role was attributed to mechanisms of integrating traditional knowledge to the planning and management of marine protected areas. Several authors support that traditional users are more able to adapt management strategies in a more efficient manner, since they have gained experience in interpret and response to natural signs, such as variability in availability of resources (Kalikoski, 2007; Gerhardinger *et al.*, 2007; Diegues, 2008; Freitas & Tagliani, 2009).

According to the authors, traditional knowledge accumulated by resource users is often complementary to more formal scientific knowledge, being able to produce more effective and equitable solutions to management challenges. Moreover, the participation of resource users during planning and management legitimizes the arrangements and agreements set out, contributing to their compliance and resulting in more effective conservation strategies.

In order to illustrate the how the integration between traditional and scientific knowledge has been performed in Brazil, specially managing marine area under multiple use interests, a practical case is described in turn. In that particular case, the aim is to exemplify the use of spatial tolls supporting and improving participatory management.

### 4.3.2. Traditional knowledge supporting GIS for fisheries co-management

Remarkable experience has made use of GIS for the integration of traditional and scientific knowledge in supporting artisanal fisheries management in southern Brazil (Freitas & Tagliani,

2009). The premise of the initiative is that the development and implementation of management fisheries policies have not been effective because of a failure to use local knowledge as one of the available sources of information to supplement scientific data (Almudi *et al.*, 2008). Such integration is seen by the authors as potential mechanism that leads to a more realistic fishery planning and management.

However, the authors understand that the recognition of the importance of traditional information to ground management initiatives is a controversial issue (Freitas & Tagliani, 2009). They verified that an usual assumption is that local knowledge is considered subjective, qualitative, and unsystematic and thus problematic for managers and decision makers. When the value of traditional practices and knowledge is recognized, still persists an absence of a systematic collection of such type of data.

In both cases, the incorporation of information and communication technologies, such as the application of a geo-spatial component, is recommended as desirable to overcome the limitations related to validation and systematisation of data. The GIS, particularly, is indicated as extremely adequate due to its capability to integrate and analyse a large number of attributes from different sources (qualitative and quantitative data) added to a the facilitation of data sharing and updating, and the generation and comparison of alternative management scenarios.

The planning area is Patos Lagoon, integrant of the Estuary with the same name, located at the extreme south of the Brazilian coast, in Rio Grande do Sul State. The estuary is inserted in a context of multiple and competitive coastal interests such as agriculture, fishing, tourism, aquaculture, ports and industrial activities. On the other hand, it has a fundamental role in local fisheries, since it is an important spawning, nursery and feeding area for several commercially important fish species, and many of artisanal fisheries communities are currently dependent upon its resources (Freitas & Tagliani, 2009).

The authors explain that the local initiative emerged from the Forum of Patos Lagoon, a collaborative partnership among communities, governmental and non-governmental organizations, operating since 2006, with the aim to provide support fisheries management based on principles of collective and constructive decision-making and sharing of management responsibilities. The database was suggested as a useful mechanism to improve management decisions.

The collection of data made use of complementary strategies: interviews conducted during and after fishing trips at harvest spots, constituting additional qualitative data, and aboard of the boats, gathering of spatial information (e.g. fishing areas and spots; species caught; bathymetry, hydrograph, etc).

The database were developed by using ArcGIS 8.3 ArcView softwares, and its construction have considered relevant entities, attributes and relationships according to the technical and policy management priorities, and data availability – no pre-conceived protocol were followed. To the local knowledge were summed scientific data on environmental variables obtained from different research institutions. The range of information translated into spatial information is described in the table 18. Three coastal municipalities, seven artisanal estuarine fishery communities and three of the most important target species of inland waters were covered by geo-referred system.

Table 18 - Main dataset included in the GIS of Patos Lagoon database.

Data Theme	Information
<i>Artisanal fisheries</i>	Species harvested, fishing grounds, number of trips, time of fishing, gears used, water depth of harvest location Villages of the main artisanal fisheries groups in the estuarine area Descriptive information of informants' interview linked to the harvest locations Natural and artificial reference features used by fishermen to name and outline their fishing sites
<i>Environmental data</i>	Landsat TM satellite image Bathymetry Coastline and islands Hydrography (lakes, rivers, streams) Land uses and vegetation Soil geology and geomorphology (riverbank, embayment, channel entrance)
<i>Socio-economic data</i>	Water regulation categories - State's technical norm Fepam 003/95 of water quality Localized sources of pollution Accessibility - Main and secondary roads Administrative division between municipalities

*Source: adapted from Freitas & Tagliani (2009).*

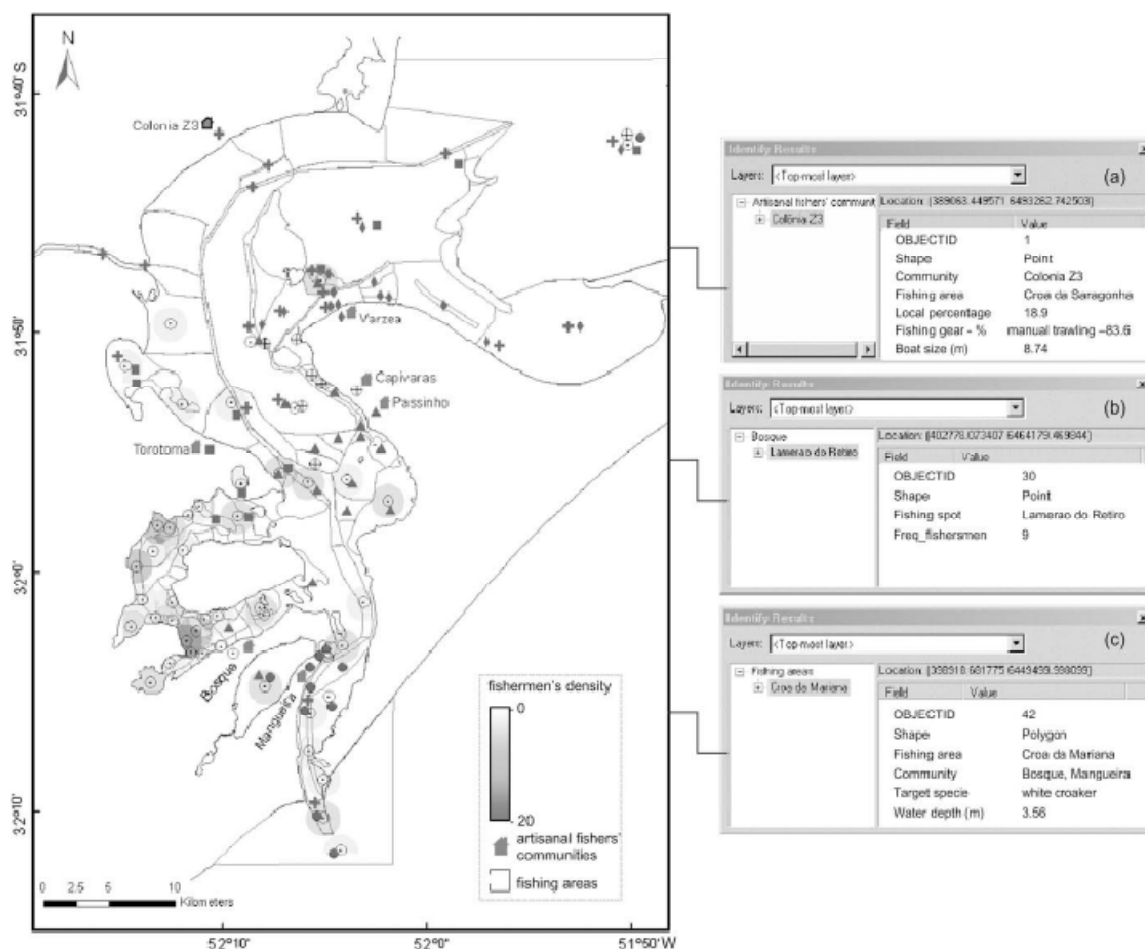
The spatial information gathered was transcribed into the GIS mapping application, composing a multiplicity of data layers that can be added or removed from view. Qualitative information, previously stored in as tables, graphics or documents, can also be included in a final map. The figure 30 illustrates the general aspect of the GIS elaborated, showing the spatial distribution and example of tabular information associated with artisanal fishers' communities (a), fishing spots (b), and fishing areas (c) for the years 2002–2003. The greyscale pattern representing the fishermen's density (number of fishermen by fishing spot) for the one of the communities (Bosque).

Freitas & Tagliani (2009) have stressed many benefits of using a systematized and spatially database for improved management of the artisanal fisheries. Some of the positive applications summarised by the authors include:

- i. Promotion of the spatial perception and effectiveness in data management;
- ii. Assignment of priorities to survey efforts;
- iii. Identification of heavily used, thus, potential conflictive zones;
- iv. Description of spatial fishing catches; and
- v. Contribution to reduce the probability of conflicts of uses.

As management tool, one of the highlighted aspects was the incorporation of natural and artificial reference features provided by local knowledge, which was seen as fundamental source of information in "resources" spatially solving border disputes about the use and management rights of over common pool resources (Freitas & Tagliani, 2009; Almudi *et al.*, 2008). Furthermore, it is a key element to overcome the usual barriers of communication existent between management

regulations and fishery communities, particularly with respect to the establishment of boundaries in a fishing right system, for instance.



Source: Freitas & Tagliani, 2009.

Figure 29 - Spatial distribution and example of tabular information developed in support of Patos Lagoon fisheries management (RS, Brazil).

The authors reiterate that the identification of fishing areas based on traditional knowledge can reduce common interpretational errors from the nautical charts, which made use of conventional information and symbols that often do not accord with fishers' designation (Freitas & Tagliani, 2009). This problem was also identified by Carvalho (2007) during the attempt to develop a tri-dimensional zoning in the Marine Biological Reserve of Rocas's Atoll.

As conclusive statement, the authors supports that the geodatabase has been an essential collaborative tool for spatial deliberations and consensus outcomes improving the management

propositions in the ambit of the Forum. However, the authors foresee the necessity to construct a user-friendly and interactive GIS-based system able to improve sharing and dissemination of local information.

In spite of the achievements so far, the study still points out the necessity to have a feedback and discussion with fishers' communities about the usefulness and reliability of the information system. Continuous involvement is also essential, considering the necessity of periodically update of the database, aiming to reflect local changes, in social and environmental terms.

With respect to the main obstacles felt, the conversion of data originating from varying and scattered sources was mentioned as main obstacle during the development of the database. Despite of that, the study concludes that the ability of geo-spatial information systems in translating information into an accessible and interpretable format was confirmed (Freitas & Tagliani, 2009). At local level, the findings of the research evidence the importance of the study as starting point in adopting a spatial approach for a better understanding of the possibilities of management of the resources in the Patos Lagoon Estuary (Kalikoski & Vasconcellos, 2007).

With further refinement, Freitas & Tagliani (2009) are sure that this approach could also be used to broader applications for information gathering about fisheries and environmental management, also able to support formulation of fisheries policy, legislation and management plans at higher levels.

In effect, this experience is just an example of how succesfull can be the adoption of GIS also to work at lower scale, been able to meet management demands with high specificity. To be effective, any proposals for specific solutions to problems in the coastal zone and any decisions about its optimal use must be necessarily site specific, although being part of a broad strategy of management. In this sense, the government must recognise the support given by such types of institutional arrangements, understading that they have assisted the country to meet its national objectives concerning the conservation of the natural resources, participatory management, and many others. Furtherome, this experience contributes to revert the situation of missmanagement attributed to the small-scale fisheries sector.

## 5. ANALYSIS OF THE BRAZILIAN INITIATIVES IN LIGHT OF INTERNATIONAL PRESCRIPTIONS ON OCEAN AND COASTAL MANAGEMENT

### 5.1. Compliance of Brazilian ocean and coastal management policies and initiatives with the international prescriptions on the theme

Considering that the major prescriptions for managing the oceans and coasts were already enforced by the international agenda worldwide, mainly by means of agreements, conventions and protocols; accounting that particular concepts applicable to the specificities of planning and management coastal and marine systems have been increasingly consolidated since the adoption of ICZM and MSP by the international community; and finally, recognising that Brazil is already organised to deliver management plans in coastal and marine areas, accounting with particular institutional and legal framework on the theme and that relevant experiences have been carried out throughout the country, the following objective is to analyse how these national initiatives have complied with the international prescriptions for management of ocean and coasts.

With concerns to broad prescriptions for ocean and coastal management, is sound to affirm that Brazilian policies are aligned with the major international recommendations on the theme, grounding simultaneously landward and seaward management issues and assuring a permanent link between coastal and marine efforts by its legal binding on the same policy, the *National Policy for Sea Resources* (PNRM), set out by the *Interministerial Commission for Sea Resources* (CIRM).

The establishment of the major legal framework was the first step, during the 80', followed by the conceptualisation of the main marine research projects also set in that decade. Later, the coastal institutional and legal framework took time to be organised and make operational, which occurred between 80' and 90', with the first diagnostic of current uses in coastal and marine areas being elaborated in 1996. The use of spatial tools, with a more strategic level of planning and adoption of the risk management perspective was incorporated very recently, after 2000.

In practice, mechanisms of planning and management in Brazil have evolved faster in fields disciplined by international conventions, in which general guidance for matters that involves shared responsibility are provided, helping to shape the national and regional frameworks on the theme. UNCLOS, ICZM, biodiversity conservation and protected areas are foremost examples of how international discussion involving complex management fields have driven Brazilian policies, helping to shape its theoretical scope (concepts, principles, objectives) as well as its institutional and instrumental design.

Even so, the UNCLOS can be seen as the primary source of external incentive to Brazil organise an administrative structure to be in charge of issues involving the management of ocean resources, recognising its strategic value. Internally, ocean management responded to political interest in assessing its strategic resources at sea space, whilst coastal efforts have mainly responded to

conflicting management issues involving variables users, sectors, and specially, environmental degradation of coastal habitats and the basis of marine resources.

In the scope of the Brazilian coastal management policy and institutional structure, the position of the CIRM as sponsor and facilitator of the coastal and marine policies deserves particular emphasis. Whilst many other coastal issues were addressed in a sectoral perspective, the CIRM has, since the beginning, was conceived to promote horizontal integration among sectorial departments of the governments involved with the management of ocean and coastal resources (such as fisheries, port, environment, etc), holding a key role for the success of the marine/coastal policy.

In effect, Brazil is referred to as an international example of a country that has established a plan of national coastal management based on principles of Integrated Coastal Zone Management (ICZM) and set specific policies focused on ocean and coastal areas, as has been widely recommended at international level.

In reality, not only the creation of the CIRM but also of the *National Policy for Sea Resources* (PNRM) have originally incorporated fundamental principles underlined by international prescriptions on ocean and coastal management, firstly, given by UNCLOS, and more recently, updated by an international meeting centred on the evaluation of ocean and coastal management 10 years after World Summit (GOC, 2008). The PNRM was born with the objective to align the diversity of sectorial policies permeating ocean and coastal environments, but understanding the inherent differences of objectives and rationalities prevailing in the management of the coastal or marine issues. For that reason, the strategy was to separate the “agenda” into coastal and marine streams of action.

In effect, the separation of coastal and ocean issues showed to be as a satisfactory way to handle the particularities of each domain, at least in the early stages of implementation of both policies (PNRM and PNGC) when institutional organisation and research were the primary focus. Forthcoming management measures must integrates both domains, making use of the growing promoted in each particular field to ground a common future path of development for those environments.

Both coastal and marine policies derived from the PNRM assumed the same mechanism of governance: existing government sectors and institutions were maintained and attention was paid to improve the communication among them. The CIRM and the GI-GERCO represent the only official bodies created with the specific charge of promote inter-sectoral integration in their respective fields of action (ocean and coastal) as well as among them. In a complementary manner, additional statutory basis was also enacted, defining the major instruments and principles for both domains, although keeping the national environmental legislation as primary ground.

The common origin and permanent connection among coastal, ocean and the broad environmental policy is rather positive, since it has harmonised the main guidelines, instruments and competences for planning and managing at federal level, which is strategic to guide sub-national efforts and subsequent integration of the results achievements. Furthermore, such scheme invariably assured



that independent of future tracks followed by the coastal or marine streams at operational level, the policies are linked at highest order of planning.

In practical terms, the series of multi-annual sectorial plans adopted by the PNRM since 1982, always centred on marine research, have enhanced the national capability to exert its maritime sovereign, also improving the allocation of sea-based activities and the possibilities to protect the marine environment – respectively, right and duty conceived by the UNCLOS to coastal nations.

Furthermore, the efforts in research composed the first panorama of Brazilian's reserves of strategic resources through the prospection and quantification of renewable and non-renewable stocks offshore and in coastal waters, which is instrumental to assist the development of sea-based sectors but is also of fundamental importance to guide future planning and management initiatives carried out at sea. Overcome the lack of information that usually poses a limitation for planning and development projects, particularly common when dealing with complex systems such as the ocean/coasts, are the first step towards a more coherent and strategic resources-based planning and indeed has been strongly recommended in the scope of international prescriptions on the theme.

A general evaluation of both lines of action of PNRM for managing coastal and seaward issues shows that is quite discernible that the coastal line received much more attention, in terms of legislative basis and institutional/ administrative arrangements seeking for put management measures into practice. The coast has historically felt the concentration of variable sources of environmental pressure, mainly, urbanisation, industrialisation, disorderly expansion of tourism and coastal economic sectors, threatening the basis of natural resources and ecosystems, abundant along coastal land and waters. Moreover, the multiplicity of property rights, private interests and stakeholders make any planning and management initiative much more complicated. Such situation was enough to call CIRM's attention to the necessity to follow international examples towards a more proper development of coastal areas.

The marine environment, on the other hand, was under limited conflicts of use and severe threats due to the reduced set of activities carried out offshore in Brazil when the PNRM was launched. Marine extractive fisheries and oil extraction, besides shipping and transportation, were the dominant uses in the 80's, usually not resulting in environmental degradation or conflicts of use in an evident manner when the CIRM instituted the marine policy. The focal point, at that time, was to guarantee the national sovereignty over ocean resources, extremely strategic for the country, and for that reason there were concentrated efforts towards marine science and research. Moreover, at sea (in Brazil), the jurisdiction is always federal - no matter if at coastal waters, Territorial Sea or beyond - which simplifies the institutional arrangements and structure for planning and management.

The main accomplishments of national framework with such broad international recommendations on ocean and coastal management are showed in the table 19.

COMMON PRESCRIPTIONS – OCEAN AND COASTS		BRAZILIAN LEGAL FRAMEWORK ON OCEAN AND COASTAL MANAGEMENT
<b>UNCLOS</b>	<ul style="list-style-type: none"> <li>- Ocean is a <i>common heritage</i> of mankind</li> <li>- Countries have the right to allocate activities and the duty to protect the marine environment</li> </ul>	<i>National Policy for Sea Resources (PNRM)</i>
<b>Objective:</b>	<ul style="list-style-type: none"> <li>- <i>Integrated management</i> as new regime for marine scientific research and framework for technological cooperation and development</li> </ul>	
Improvement of ocean governance	<ul style="list-style-type: none"> <li>- Coastal nations have the duty to adopt laws, regulations and other measures to prevent, reduce and control all type of pollution (land- and ocean based)</li> </ul>	<ul style="list-style-type: none"> <li>- Specific administrative/institutional arrangement to allow sectorial integration, represented by the CIRM itself in charge of ocean affairs, and a specific coordinating commission for coastal issues (GI-GERCO - Group of Integration on Coastal Management)</li> </ul>
<b>The Global Conference on Ocean and Coasts</b>	<ul style="list-style-type: none"> <li>- Need to detect and predict changes in the coastal ocean - advance of scientific monitoring and understanding</li> <li>- Communication, collaboration, and coordination of existing institutions and programs at the global, regional, and national levels rather than through the creation of new institutions</li> <li>- Importance of ensuring compatibility and complementarity of planning at the various administrative levels</li> </ul>	<ul style="list-style-type: none"> <li>- Networking mechanism of governance (existing government sectors, institutions and legislation were kept, improving the communication among them) although new legislation on the theme was also enacted</li> </ul>
<b>Objective:</b>	<ul style="list-style-type: none"> <li>- The higher levels of administration must provide an integrated legal and institutional context, directing and aligning local and regional planning</li> </ul>	
Evaluation of ocean and coastal management 10 years after World Summit	<ul style="list-style-type: none"> <li>- Improvement of ocean governance requires adoption of national measures for international agreements concerning the issues of global importance</li> <li>- Regional level ocean governance must be enhanced</li> <li>- Encouragement of national and sub-national levels for the creation of legal and institutional frameworks, focus the attention of decision-makers</li> <li>- Transparency and participatory processes, based on scientific data, technical and local knowledge</li> <li>- Expressions of integration: Environment protection &amp; development; coastal &amp; ocean issues management; international/ national/ sub-national levels cooperation; variable disciplines and fields of research</li> </ul>	<ul style="list-style-type: none"> <li>- Decentralisation of management responsibilities and distinct strategies of action, for ocean and coastal issues, inclusive in a sub-scale of the coast (Sectoral Plans; PNGC; LEPLAC and Antarctic research)</li> <li>- Incorporation of flexible mechanisms of adjustment, performing by means of sectoral plans (allowing review/ monitoring of efforts and continuous identification of new demands of management), later legal enforced</li> <li>- Substantial investments in research (especially at marine domain)</li> <li>- Realignment of the range of public policies with direct or indirect influence on coastal zone</li> </ul>

Table 19 - Main accomplishments of Brazilian framework with respect to broad international recommendations on ocean and coastal management

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With respect to the compliance of Brazilian legal framework on coastal management with international prescriptions of Integrated Coastal Zone Management (ICZM), another table is provided (table 20) aiming to systematise the main accomplishments of national efforts in relation to the international agenda, in theoretical and practical terms.

In effect, the legal framework and theoretical basis specifically supporting coastal management in Brazil already have crucial aspects of ICZM prescriptions, although is still lacking to put some of those into practice.

In general, Brazil has adopted a strategic scope of planning and management, usually encompassing the whole-of-jurisdiction of the coastal zone, including the Territorial Sea, whose principles were introduced by the legal basis and also executed in practice. Moreover, there has been conceived the elaboration of operational plans at regional and local scale, since based on the principles given at federal level. Such scheme evidences the emergence of a strategic planning approach. The basis of the coastal management plan is fundamentally statutory, making use of a specific legal framework to enforce variables scales of planning and use of a specific range of tools to support planning and management decisions.

The national policy on coastal management incorporated principles of decentralisation and integration among levels of government and sectoral agencies, although major part only in theory. Decentralised administration has been promoted mainly through granting autonomous power to sub-national levels of government (states and municipalities), which might be the origin of some problems related to political disruptions mainly observed at municipal level, compromising the efficiency of planning and management tools at local scale. Furthermore, the existence of overlapping responsibilities or divergent interests still result in conflicts between federal, state and municipal instances concerning the use of space and resources, leading the goal of “institutional integration” to a state of partial implementation, in practice. In effect, this absence of cooperation and coordination at governmental level must be overcome in order to make feasible the achievement of compromised solutions in the ambit of planning and management efforts, for instance, in conducting a coherent territorial zoning at all levels, in an integrated manner. Nevertheless, it is also true that decentralisation of planning also faces remarkable differences among coastal states with respect to infrastructure and capability of the teams in charge of the coastal management; level of social organisation; dissonant socio-economic realities, and some other local/regional factors.

Whilst active involvement of coastal state and municipalities have seeking for horizontal integration among levels of administration, the CIRM and GI-GERCO have played their roles in promoting horizontal integration. Since their major institutional scheme are already structured, with the range of respective competences defined, in most cases deliberating and working effectively – as could be seen in the Action Plan for Coastal Zone, elaborated by the GI-GERCO – further improvements are necessarily dependent on internal evaluations of institutional performance, aiming to detect, correct and overcome possible failures in the system. Anyway, continuity must be given to these bodies, which is expected to enhance its long-term institutional maturity, through a “learning-by- doing” process.

Nevertheless, political obstacles have proven to be the major barrier at all levels of administration for effective implementation of the coastal management. The challenge is also high at municipal level, possibly due to the high level of power attributed to sub-national levels, facilitating political biasing. It is urgent a rupture of political oligarchies, privileged sectors linked to politicians, directional consultancies and other forms of political disruptions.

The multiple use approach has been quite incorporated in the policy basis, but has been partially performed due to the dominance of some sectors in detriment of others. Is possible to affirm that the government has recognised the strategic interest in managing coastal and marine areas in a integrated manner mainly due to the necessity to deal with some particular sectors, such as oil, natural gas, mineral exploitation as well as industrial fisheries, whose performance is basically concentrated offshore but completely dependent on land-based support facilities.

Is matter of fact that the implementation of the National Plan on Coastal Management and its instruments has advanced in recent years, despite the unequal development identified in different regions along the Brazilian coast. There is also evident that there is still a distance between its conceptual basis and practice. Nevertheless, since the majority of federal level has assumed a strategic scope of planning, making use of variable tools to achieve identification of critical areas, resources inventories and mapping, mainly with the function of area planning, promotion of economic development, stewardship of resources and risk management, the whole coastal society and economy is expected to be benefited.

Another aspect still partially developed in the ambit of coastal management practices is the identification of projected uses, going beyond to the characterisation of the current scenario, seeking for spatial but also temporal compatibility among the multiplicity of uses. Nevertheless, the PNGC has, at least in theory, a comprehensive basis for land use planning given by the ZEE approach, which conceives elaboration of future scenarios. If responsibilities and steps established in ZEE legal basis were assumed in an effective manner, this tool would be able to give promising results at national scale, mainly achieving a multi-sectorial planning, changing some (inappropriate) patterns of land use, leading to a better management of socio, economic, cultural and natural resources. The recent standardisation of ZEE procedures (concluded in 2007) tends to overcome the current barriers for ZEE implementation.

However, is also important to born in mind that choice of a desired path or scenario of development does not constitute a merely technical choice, but fundamentally, a political option.

Improving of knowledge about the interconnection between coastal and marine uses, processes and influences has representing the major achievement of the coastal policy in Brazil, which has experiencing the process of building its science and information base - a central element in any early stage of planning. In fact, such intention is integrant part of coastal and marine policies and has been truly performed on both environments, mainly executed at federal level, but contemplating variable scales of analysis and employment of spatial tools.

In effect, the construction of the science and information basis current observed in the ambit of coastal management practices is truly positive; in a forthcoming moment, such database will be able to provide reliable and accurate data to guide decision-making with respect to managerial

issues in the ocean and coastal environments. However, the emphasis given to spatial management techniques, such as Geographical Information Systems (GIS) and digital processing must be accompanied by major concerns with the use and dissemination of such information for driving elaboration of management measures.

In practical terms, the next goal must be to improve and make operational the federal information system to gather, analyze and share data on socio-environmental information along the Brazilian coastal and marine spaces, making feasible some key monitoring instruments, such as environmental report for instance. In this sense, aggregation of the Macro-diagnostic data in the GeoNetwork represents the first step to be executed, allowing a spatial perspective of management problems and major demands for forthcoming actions, including social and environmental risk management, coastal urban planning, and so forth.

With respect to the differentiation in streams of planning and management adopted by the National Policy for Sea Resources (PNRM) – coastal vs. marine – it is possible to assume that it has resulted in better “tailored” actions to face particular demands, objectives and rationalities that must guide the management efforts in each domain. In this sense, the PNGC and its developments specially in the ambit of the Action Plan for Coastal Management can be seen as an effective way to focuses on specific obstacles and/or strengths present in different components of the coastal zone, sometimes related to land use planning, ecosystem protection or environmental control, allowing the development of particular actions for specific sectors (e.g. harbour, oil, etc).

With concerns to implementation of monitoring, evaluation and feedback as planning' phases, is evident that those concepts are, in practice, underdeveloped in Brazil, resulting in lack of acknowledge about the effective results achieved by coastal management measures, inclusive those developed in the ambit of protected areas. Despite the existence of quantitative data about level of application of PNGC instruments along the coastal states and municipalities it is not enough data for supporting feedbacks and policy improvements; even though , it has still being considered as a partial achievement. The national coastal policy has demanding qualitative data, establishment of indicators of progress and success of the coastal policy as well as a continuous evaluation process of the actions carried out - which must be done by the official bodies in charge of such task to have validity. A bi-annual analysis of how integration has been performed could be an interesting measure to be taken at federal level, as example of European Union Commission with respect to the implementation of community policies related to ICZM and MSP.

On the other hand, the majority of evaluations of the coastal programme identified in the national literature were carried out in the ambit of universities and research centres/teams committed with the theme, indicating to the possibility of a promising connection between science and policy-making.

In general, the principle of interrelationship and integration among environmental protection and development has been concretised due to legal enforcement of national targets on protected areas, which also applies for islands and marine environments. Some other international concepts are almost completely missing of the coastal policy basis, such as inter - and intra-generational equity principles and polluter-pays principle. Although its premises are barely present in some legal

documents, they have not been incorporated in the scope of the recent initiatives on ocean and coastal management analysed.

In effect, prevention and mitigation of impacts have been the major driven forces identified in the most planning initiatives carried out by the federal government when making use of the instruments foreseen by the coastal policy, mostly in theory, still lacking some effective practical measures to achieve such aim. Therefore, is sound to affirm that the environmental safeguard and precautionary principles have been responded, although are evaluated as partially implemented due to the lack of practical measures to cope with conflicting issues, such as those identified in the scope of Macro-diagnostic. Measures to avoid environmental and social damages, such as relocation of population of risk areas, improvement of sanitation and garbage collection are still missing from political agenda at national scale.

The low culture of cooperation is not an exclusive feature of governmental bodies, levels of governments and sectors of administration – it is also found in the private sector and even in the society as a whole. Participatory decision-making is still emerging in Brazilian reality, although some interesting examples of users involvement in resources use planning and management have been shown the potential of merging social and governmental institutions, as can be seen currently in RESEX and some participatory fisheries arrangements throughout the coast.

Unfortunately, although broad participation of society was foreseen since the beginning of discussion about the national programme on coastal management, outcomes of stakeholder involvement has not been accounted by official bodies and it seems to be a missing aspect particularly at national and state level. Although transparency and public participation is not a reality in the current PNGC, the increasing discussion of coastal management motivated by the third sector and research centres through regular meetings on the theme tends to overcome such barrier.

As general conclusion, despite some valuable achievements so far - simultaneously related to marine affairs, in the ambit of territorial sea and coastal waters and the terrestrial portion of the coast - there are some potential barriers still to overcome to achieve an effective integrated coastal zone management throughout the country.

INTERNATIONAL PRESCRIPTIONS OCEAN AND COASTAL MANAGEMENT	BRAZILIAN LEGAL FRAMEWORK AND OUTCOMES ON OCEAN AND COASTAL MANAGEMENT	
<i>INTEGRATED COASTAL ZONE MANAGEMENT (ICZM)</i>	<i>NATIONAL PLAN ON COASTAL MANAGEMENT (PNGC)</i>	
<i>Objective: Integrated and multi-sectoral planning</i>	<i>Theory</i>	<i>Practice</i>
- Integrated management of coastal and marine areas under national jurisdiction	Yes	Yes
- Horizontal and vertical integration among levels of administration	Yes	Partially
- Multiple-use approach covering the range of marine and coastal sectors and activities	Yes	Partially
- Use of variable instruments of planning and management	Yes	Yes
- Identification of existing and projected uses, as well as their interactions, seeking for compatibility and balance of uses	Yes	Partially
- Common will and consensus building about the strategy of action - variety of sectors and user must be bringing to the process as soon as possible	Yes	Partially
- Improving of knowledge about the interconnection between coastal and marine uses, processes and mutual influences	Yes	Yes
- Tailoring the proposal to social, cultural, economic and political characteristics of the nation	Yes	Yes
- Monitoring and evaluation programmes	Yes	Partially
- Principle of interrelationship and integration (among environmental protection and development, as well as among its multiples issues and sectors)	Yes	Yes
- Inter - and intra-generational equity principles (current options cannot preclude the options of future generations)	Partially	No
- Environmental safeguard principle (prevention of environmental harm through anticipatory measures rather than posterior efforts to repair or compensate for it)	Yes	Partially
- Precautionary principle (lack of scientific certainty is no reason to postpone action to avoid potentially serious or irreversible damage to the environment)	Yes	Partially
- Polluter-pays principle (environmental costs of economic activities must be internalised by the sector rather than imposed on society as a whole)	Partially	No
- Transparency principle and other process-oriented principles (public involvement, transparent and open process, encouragement of broad participation)	Yes	Partially

Table 20 - Main accomplishments of Brazilian legal framework on coastal management with respect to the international prescriptions of Integrated Coastal Zone Management (ICZM).



With respect to the specific objective to examine how Brazilian initiatives have incorporated the management of sea uses and to which extend they have addressed the resolution of conflictive interests, making use of techniques and instruments mostly recommended and discussed worldwide, another summary table is presented (table 21). In this table, the marine-based initiatives identified throughout the country are analysed in light of some key planning elements supported by international prescriptions on marine spatial planning.

Among the range of sea-based planning experiences described in this study, the majority of them have covered the whole coastal federal jurisdiction, therefore, including coastal land, Territorial Waters and Exclusive Economic Zone, confirming that landward and seaward issues have been handled, in practice, in an integrated manner.

It is also frequent the legal binding, with federal initiatives responding to governmental priorities in variable fields of action, specially with respect to oil sector development and risk management as well as biodiversity conservation - focuses that correspond to international agreements of which Brazil is signatory. Nevertheless, the Macro-Diagnostic also included a range of other demands of planning at lower level, such as erosion, organic pollution (sewage discharge), among others.

In effect, the major economic sectors are, as expected, the most demanding in terms of strategic and operational planning, not specifically due its increasing involvement in sectorial and environmental conflicts, but mainly, by its economic appeal that also meets governmental intentions. The growing of oil sector has been specially accounted by planning initiatives due to the high potential of growth expected to the next years. In that sense, it proves that leading economic sectors have been a particular role in prompting marine planning and management efforts, as has been experienced in the North Sea due to the growing of wind farms, for instance. Shrimp farm sector, despite its ongoing and predicted growth, does not necessarily meets political aims and its profits belongs exclusively to the private sector, with no major repercussions on public policies, such as oil sector has in the ambit of energy policies. Therefore, no attention has yet been paid to this activity.

Federal actions in the ambit of PAF have also responded to demands of harbour sector, and the introduction of ballast water management and deposition of dredging materials constitutes an advance in the planning of correlated activities of the sector. Furthermore, these are issues whose management is internationally recommended due its high level of impact on marine ecosystem.

With concerns to the instruments employed, only recently Brazil have made use of spatial tools as executive instrument aligned to the Ministry of Environment and to the coastal policy. Even so, the evolution made in improvement of knowledge and digital processing systems for integration and management of information seems to be major achievement of the coastal policy nowadays. In that sense, it is likely that the ongoing situation of lower scientific-technical involvement in coastal management decision tend to be reverted in forthcoming years.

In general, zoning maps and GIS have been the major used planning approaches in the scope of federal initiatives, being also foreseen, at least in theory, for management of marine protected



areas. Since the study just focused on general data on MPA theme, analysing only one practical case, no more inferences can be done in that sense. The same premise is valid for participatory fisheries arrangements. Nevertheless, this later practical case has given an interesting example of how successful can be the adoption of GIS to work at lower scale, being able to meet management demands with high specificity, to involve directly the users of resources, and also to translate cognitive information and traditional knowledge into a strategic planning.

However despite the use of spatial and processing tools at variable scales of planning, meeting different interests at stake, there is yet no specific instrument that contemplates the particularities of planning at sea, particularly with respect to the absence of physical boundaries, the transboundary nature of numerous marine resources and the tri-dimensionality of the marine space.

At federal level, all the range of planning and management initiatives identified in marine areas was always associated with the management of coastal issues, and have been mainly assumed a strategic scope of planning, making use of spatial tools to achieve identification of critical areas with specific management priorities. But, despite the focus given to conflicting issues, the major part of the projects has not concretely focus on mechanisms of conflict resolution. Emphasis has been given to the consolidation of comprehensive basis for risk management and mitigation, especially with respect to oil exploitation and biodiversity conservation.

The analysis of spatial and temporal compatibility of uses was performed, in practice, only by the SAO Charts and Areas of Temporary Exclusion for Oil and Gas Activities at federal level, which differentiated areas of biological importance and reproduction periods to drive the execution of oil exploitation activities. The mapping of Areas of Temporary Exclusion of Oil and Gas Activities, in particular, characterises an innovation on marine planning and management in Brazil and constitutes in the first concrete attempt to deal with conflicting activities by using arrangements based on temporal separation of conflictive activities that competes for the same area, which has been seen as an innovative approach specially adopted in the scope of international marine spatial planning principles.

Nevertheless, despite low adoption of the compatibility concepts in planning protected areas, in practice, the roadmaps to support the preparation of management plans in both categories of UC (no-take and RESEX) have conceived variable spatial arrangements for resources management, as well as time-based arrangements, such as temporary exclusion of activities for a specific purpose (e.g. reproduction of a given specie). But with respect to the planning at sea, there are no particular mentions about the possibility to improve the compatibility of uses by making use of the tri-dimensionality of the sea. In practice, only one case in Brazil assumed such idea, with declared influenced by international experiences (namely Great Reef Barrier). This situation is a clear example that international context not only promote legal enforcement for issues of global importance, as MPA, it has also provided the practical elements for achieving better results, mainly due to the “sharing” of best practices recently introduced also at policy making level.

In majority, Brazilian initiatives are concentrated in characterising current uses, with no major concerns with analysis of potential uses or development of scenarios. Nevertheless, the multiplicity of federal initiatives focused on the consolidation of a comprehensive database of resources and

spatial representation of uses are particular important to support assessment of management measures' performance, definition of indicators of environmental quality and is also an effective manner to observe changes and trends in the use of coastal areas and its resources. Moreover, concrete information basis leads to development of more comprehensive strategies of planning and management, allowing expansion of spatial and temporal scope of planning.

Nevertheless, the SAO Charts and the Macro-diagnostic, even not using, exactly, the construction of "future scenarios", have improved the temporal perspective of analysis by focusing on risk management, which constitutes a precautionary perspective of planning. Even considering just one particular "scenario", the possibility of a technological accident, it is a way to think about future conditions for a given area, offering a practical basis for operational measures. In effect, the SAO charts can be regarded as practical examples of how strategic level planning gives support to operational decision-making, in this case, with regards to protection of coastal marine ecosystems and human life during combat and respond to oil spills, namely, through the incorporation of the data compiled by the charts into a National Contingency Plans.

With concerns to the adoption of an ecosystem-based management, is possible to affirm that all initiatives have considered, in more or less intensity, its concepts, considering ecosystem as major unit of planning instead of physical, legal or other boundaries.

Monitoring and evaluation are also missing aspects in major case of the planning initiatives identified, usually not even been part of the plan (regarded as not available). In the case of protected areas, it just does not occur, in practice. Despite the proliferation of MPAs along the national coast, the number of UCs which has made use of its legal instruments of management (Council, Management Plan and Zoning) is not compiled by official statistics. There is also a lack of studies evaluating their current level of implementation or effectivity as instruments of planning and management at sea.

With respect to support instruments of coastal management, the sustainable use protected areas (RESEX) and participatory fisheries management are where the issue of participation and tailoring the initiatives to the local context have been better performed, improved by the local scale of action. In the case of RESEX, the legal framework for coastal communities to participate in the planning and running of protected areas through participatory management is legally provided. On the contrary, participatory arrangements, just in few cases, are legally binding, but it would be quite desirable. The recognition of variables institutional social agreements in the use of resources would be the first step to lead local strategies to support a higher order of planning, at policy-making level, for instance. Effective participation of both government and users in the fisheries administration represents a viable way to achieve the decentralization and to improve conflicts resolution, either between or within the fisheries sector.

Current experiences, specially in the ambit of RESEX and fisheries management, are a clear indicative of the potential of local communities to offer supporting elements to guide the formulation of innovative experiences towards the management of marine resources. Since the

general concepts of co-management and steps for achieving such aim are already given, forthcoming efforts should give priority for capacity building inside the communities, enhancing the potential and role of participation in the management. In that manner, the integration between variable scales of planning and practical strategies of action - at federal, state local and site level - tend be also improved.

INTERNATIONAL PRESCRIPTIONS OCEAN AND COASTAL MANAGEMENT	BRAZILIAN LEGAL FRAMEWORK AND OUTCOMES ON OCEAN AND COASTAL MANAGEMENT					
MARINE SPATIAL PLANNING	MARINE-FOCUSED INITIATIVES OF PLANNING AND MANAGEMENT					
	Coastal Policy Instruments			Support instruments National System of Protected Areas (SNUC)		
	Federal Action Plan for Coastal Zone		Macro-diagnostic	MPA		Informal mechanisms
	Priority Areas for Conservation of Biodiversity	SAO Charts / Areas of Temporary Exclusion (Oil and Gas)	Macro-diagnostic of the Coastal Zone	MPA (no-take)	Marine RESEX	Participatory Fisheries arrangements
KEY ELEMENTS OF PLANNING	Coastal/TS/EEZ	Coastal/TS/EEZ	Coastal/TS/EEZ	Variable	Variable	Variable
Spatial scope	Yes	Yes	Yes	Yes	Yes	No
Governmental priorities	Yes	Yes	Yes	Yes, in theory	Yes, in theory	Rarely
Zoning Mapping	Yes	Yes	Yes	Rarely	Rarely	Rarely
GIS	Yes	Yes	Yes	Yes, in theory	Yes, in theory	Rarely
Analysis of compatibility (spatial/ temporal)	No/No	Yes/Yes	No/No	Yes, in theory	Yes, in theory	Rarely
Characterisation of current uses	Yes	Yes	Yes	Yes	Yes	Yes
Development of scenarios (potential uses)	No	Partially	Partially	No	No	No
Legally binding	Yes	Yes	No	Yes	Yes	Rarely
Precautionary principle	Yes	Yes	Yes	Yes, in theory	Yes, in theory	Is supposed to
Ecosystem-based management	Yes	Yes	Yes	Yes, in theory	Yes, in theory	Is supposed to
Monitoring and evaluating (plan review)	N/Avaliable	N/Avaliable	Yes	No	No	N/Avaliable
Public Participation	N/Applicable	N/Applicable	N/Applicable	Rarely	Yes	Yes
Tailoring to the nation's demands and context	Yes	Yes	Yes	Yes	Yes	Yes
Integration with more comprehensive coastal planning and management efforts	Yes	Yes	Yes	No	No	Rarely

Table 21 - Main accomplishments of Brazilian initiatives of sea uses management with respect to the international prescriptions of Marine Spatial Planning (MSP).

In general terms, become evident that a variety of spatial approaches have been employed to meet distinct planning and management tasks, at different scales, showing potential applicability for landward and seaward issues, which indicates the possibility of merging MSP as a particular tool that perfectly aligns with the purpose of an integrated coastal zone management.

Face to such potential of integration is possible to affirm that what has still lacking in the ambit of the legal framework on ocean and coastal management in Brazil is the consolidation of a specific tool, with a spatial component, readily applicable to seaward management issues. The objective must be legally bind a single approach, with specific criteria, which should be enforced throughout the country regardless the institutional context prevailing – PNGC, ZEE, federal inventories and mapping or MPA. Hence, the main feature of marine planning efforts would be given by the particularities of planning and managing a system with such complexity as the sea, and not by one policy context or another – “sustainable use of marine resources” is an international prescription common to ocean management that applies to the diversity of fields.

### **5.2. Concluding remarks on the perspectives of ocean and coastal management in Brazil**

In fact, the integrated management of coastal areas is a complex, difficult, long and interactive. There is no model of ocean coastal management in the world able to present definitive and effective solutions that can be directly transplanted to other regions. All over the world, coastal nations have seeking for solutions through a process of groping, often using the principle of learning-by-doing, being primarily guided by international prescriptions on the theme.

An aggravating factor is that each coastal zone has its own peculiarities that distinguish it from all others, in environmental, social, economic and cultural terms, therefore, a successful management initiative can only be performed if the totality of agents, process and relationships operating in the ocean and coasts were well understood, improving the effectiveness of planning measures. Therefore, it is fundamental to increase levels of knowledge about each of the components of coastal systems. In this context, the dissemination of scientific knowledge, the adoption of innovative techniques and approaches, the systematization of the factors affecting the coastal areas and the exchange of experiences acquired special importance for the improvement of this field of research.

Considering the prominent position that Brazil occupies at international scene, in terms of population, economy and possession of significant part of global natural resources, including water reserves, forest, renewable and non-renewable marine resources, effective management measures are truly strategic. The major change of behaviour must first came from political level, where a complete change of rationality is mandatory, giving preference to long-term benefits from well-grounded development, not from those running by economic growth in which the natural capital has a secondary role.

A brief analysis of the environmental pressures prevailing in the country was able to show the major social and economic patterns that must be changed or adapted to a more comprehensive and coherent planning approach. In this context, “comprehensive” mean integration of social and economic demands to environmental ones whilst “coherent” refers to the search for a balance among all interests coexisting in the coastal zone, not exclusively the imperative of economic growth more recently assumed by developing countries worldwide, including Brazil.

The federal government must begin to understand the whole environment as a strategic sector, along with hydrocarbons, minerals, harbours and industrial sectors. The intrinsic dependence of coastal sectors on natural resources, renewable or non-renewable, and to the well-known consequences of a uncontrolled exploitation of them indicate that is of foremost importance the maintenance of the basis of natural resources, since is at stake the survival of the entire natural, social and economic system. Considering the preminent emergence of strategic planning and risk management at deferral scale, the future of ocean and coastal management tend to be increasingly more preventive and comprehensive.

A specific challenge to overcome to achieve an effective strategic environmental-based planning in Brazil refers to the inter-agency cooperation and their respective capabilities to create investment opportunities. Although the national government initiative was the major catalyst for initiating the process of coastal management, responding to international demands, the country does not account with international funding and support, as has been verified in other nations worldwide. As long as is required more from government agencies, in terms of put into practice management measures, greater resources (financial, human and infrastructure) must be made available. Therefore, a mix of skills and resources are the basic procedures to increase the response capacity of the agencies, especially those in charge of costal management.

A final issue refers to the participation of broad segments of society in decision-making process and the composition of forums to enable discussion between different stakeholders. The lower level of participation and involvement of the society in decision-making is attributed to an insufficient divulgation, which difficult a better understanding of the process and the meaning of the costal management, and in turn, also interferes in the ability of the coastal plan to meet the demands of society. Such demand reinforces the importance of expanding the space and scope of local initiatives, as well as the necessity of more investment in engagement of local community, diffusion of information and raising public awareness, about the importance of managing the coastal and marine resources, as well as about the benefits of participation itself.

With respect to the future perspectives for ocean and coastal management in Brazil, since ICZM and MSP objectives and principles of planning keep close relations, is possible to suppose that marine spatial planning can be easily incorporated in the management of the marine component of the coastal zone throughout the country.

In effect, Brazil has great potential to develop a plan of marine space better than it has been done in the coastal zone, since the pressures are still emerging. It would be an opportunity to correct the management mistakes identified and to act proactively in the marine space, our immense “Blue Amazon” whose potential is still latent and being discovered quite fast in the last years. Therefore,

future marine spatial planning is an approach that could promote an effective management of the marine space and resources demands, which must, and will, require increasing scientific-technical support of the academy, as well as the participation of civil society and private sectors.

Nevertheless, the adoption of MSP principles in a generalised and systematic way necessarily demand a specific planning approach for the marine component of the coastal zone, as has been done by the European Community in the ambit of its *Integrated Approach to Marine Governance*. In that sense would be firstly necessary that MSP was recognised by the national policy, therefore, it should be enacted as instrument of planning, as the government has done with the ZEE.

As concluding remarks, this study stress that MSP and ICZM contribute to meet numerous of the international commitments made by coastal nations worldwide, and allows an improved predictability for planning at coastal and marine areas, being particular useful to cope with risk management, to driving future investments and to improve the maintenance of ocean goods and services. And Brazil has following that idea.

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## **LEGAL FRAMEWORK CITED**

- BRASIL - Federal Law nº 6938/81 - Institutes the National Environmental Policy (Política Nacional de Meio Ambiente)
- BRASIL - Federal Law nº 7.661/88 - Institutes the National Plan of Coastal Management – PNGC (Plano Nacional de Gerenciamento Costeiro).
- BRASIL - Federal Law nº 9985/2000. SNUC - Institutes the National System of Protected Areas (Sistema Nacional de Unidades de Conservação).
- BRASIL - Federal Decree nº 5300/2004 that regulates the Law nº 7.661/ 1988 of the National Plan of Coastal Management - PNGC (Plano Nacional de Gerenciamento Costeiro).
- BRASIL - Decree nº 1530/1995 – Enacts the United Nations Convention Law of the Sea of 1982.
- BRASIL - Decree nº 5377/2005 – Enacts the National Policy for Sea resources (Política Nacional para os Recursos do Mar)

BRASIL - Decree nº 5382/2005- Sanctions the VI Sectorial Plan for Sea Resources (Plano Setorial para os Recursos do Mar).

BRASIL - Decree nº 4297/ 2002 – Sanctions the Ecological Economic Zoning (ZEE) as instrument of the National Environmental Policy

BRASIL - Decree nº 6678/ 2008 - Sanctions the VII Sectorial Plan for Sea Resources (VII Plano Setorial para os Recursos do Mar).

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## ANNEX I

International agreements, voluntary instruments, and programs of action on oceans and coastal areas that have been negotiated and/or come into force in the last decade (1990 – 2000).

<i>Theme</i>	<i>Agreement</i>	<i>Year</i>
<b>Law of the Sea</b>	United Nations Convention on the Law of the Sea (UNCLOS)	1994
	International Seabed Authority (ISBA)	1996
	International Tribunal on the Law of the Sea (ITLOS)	1997
	Commission on the Limits of the Continental Shelf (CLCS)	1997
<b>Marine environment</b>	Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships	1993
	Convention on the Protection of the Black Sea against Pollution	1994
	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA)	1995
	Agreement establishing the South Pacific Environment Programme (SPREP)	1995 (into force)
	International Convention on Oil Pollution Preparedness and Response	1995 (into force)
	Protocol to the London Convention	1996
	Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region	1996 (into force)
	Declaration on the Establishment of the Arctic Council	1996
	Annex VI to MARPOL 73/78 on Regulations for the Prevention on Air Pollution from Ships	1997
	Convention for the Protection of the Marine Environment of the North East Atlantic	1998 (into force)
	OSPAR and Helsinki Convention	1998 (into force)
	Protocol on Environmental Protection to the Antarctic Treaty	1998 (into force)
	The Protocol Concerning Pollution from Land-based Sources and Activities to the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region	1999
	New timetable for Annex I to MARPOL 73/78 (Oil Discharges) for phasing out single hull oil tankers	2001

<b>Marine safety and liability</b>	International Convention on the Control of Harmful Antifouling Systems on Ships	2001
	Stockholm Convention on POPs	2001
	International Convention on Liability and Compensation for Damage in connection with the Carriage of Hazardous and Noxious Substances by Sea	1996
	Liability Protocol to the Basel Convention	1999
<b>Sustainable use and conservation of marine living resources</b>	International Convention on Civil Liability for Bunker Oil Pollution Damage	2001
	Agreement to Promote Compliance with International Conservation and Management Measures by Vessels Fishing in the High Seas ("Compliance Agreement")	1993
	New regional fisheries management organizations established or in preparation (Commission for the Conservation of the Southern Blue Tuna—CCSBT, South East Atlantic Fisheries Organization—SEAFO, West and Central Pacific Organization, Convention for the Conservation and Management of Pollock Resources in the Central Bering Sea)	After 1993
	Code of Conduct for Responsible Fishing and four related International Plans of Action (IPOAs)	1995
<b>Marine biodiversity</b>	Agreement for the implementation of the Provisions of the UN Convention on the Law of the Sea Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks ("Fish Stocks Agreement")	2001
	Jakarta Mandate on the "Conservation and Sustainable Use of Marine and Coastal Biological Diversity"	1995
	International Coral Reef Initiative (ICRI)	1995
	Annex VI to OSPAR Convention	1996
<b>Rio Principles</b>	Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean	1996
	Cartagena Protocol on Biosafety	2000
	The precautionary principle, part of the Rio Principles on Environment and Development, is increasingly being incorporated into agreements	

*Source: Adapted from "The Global Conference on Ocean and Coasts at Rio +10" (UNESCO, 2001)*